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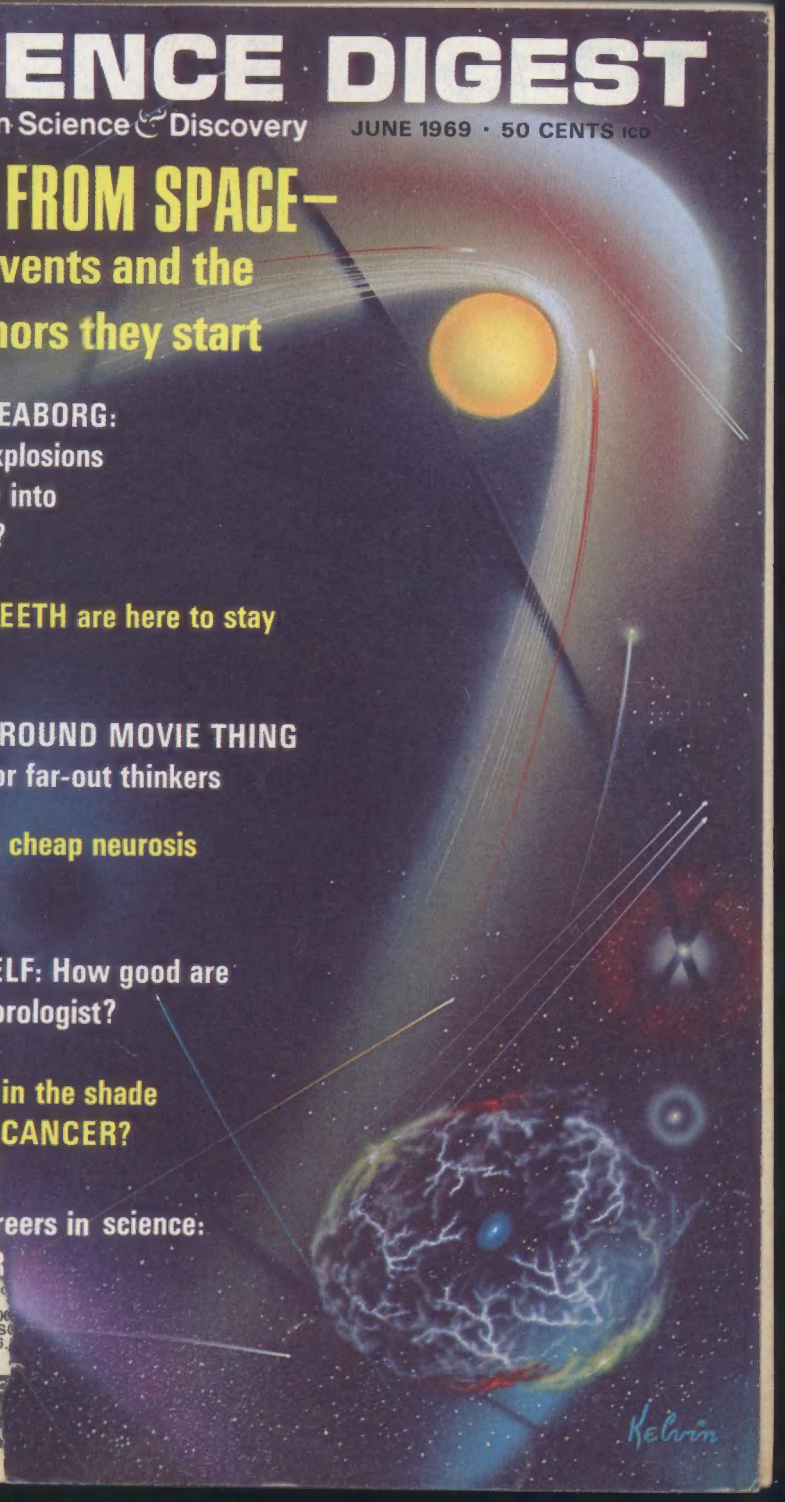

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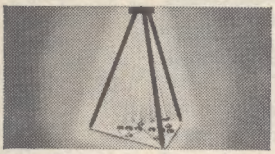

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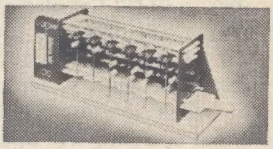

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Cape Town, South Africa—For anyone intrigued by unbelievable, unlikely places (scientifically, politically, historically or any other way), this fascinating country has no peer.

Last week, a Bantu witch doctor rolled her bones for *Science Digest*, explained the story behind each knuckle piece, shell and rib chunk, showed me her roots and medicines. She described their uses and explained why MDs often refer patients to tribal witch doctors in this strange land. "They must," she said. "We can get rid of the evil spirits;

THIS MONTH

they only rid the disease." She wasn't joking. Neither was the white scientist I talked to who confirmed everything she said. A report on the role of witch doctors in South African tribal societies will appear soon.

So will an article on the robust job of rangers in the great Kruger Park game reserve. Working with crossbows and darts, these fellows have tangled with lion, buffalo, elephant and other denizens of the Transvaal's low veld, in their constant efforts to control the park's unique ecology.

There will be reports on a fascinating afternoon spent with Dr. Christiaan Barnard in his tissue transplant laboratories; on what it's like to work two miles deep in the earth in the world's richest gold mine, where "rock bursts" from the pressure of two miles of rock overhead create havoc with frightening frequency; on the research in the great diamond mines; on the sprawling, modern Bantu towns and one of the most curious societies that ever existed.—*RFD*

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Mysterious cosmic events have long been fuel for doomsday prophets to cry "Fire." Comets were once thought to be signs sent from the gods of impending disaster, but even as recently as last year people were awaiting the end of the earth because of an approaching asteroid called Icarus. For details, see p. 14.

Cover painting by George V. Kelvin

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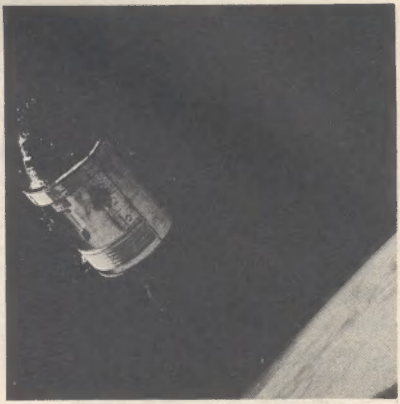
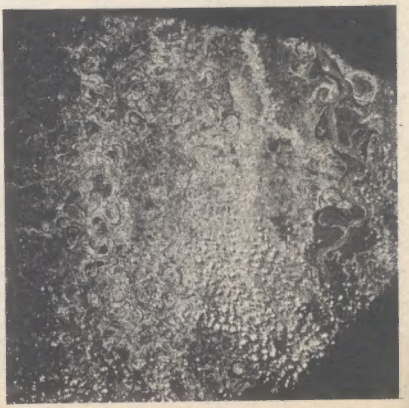
NEWS IN BRIEF / Bulletins at press time



MORE STARTLING PICTURES OF SPECTACULAR SPACE FEATS were a dividend of the Apollo 9 mission in March. The photo above left is the Lunar Module, detached, with spidery landing gear deployed; at right is "Gumdrop", the Command Module. Each was photographed by an astronaut in the other. McDivitt and Schweikert transferred in orbit from Gumdrop to "the spider" (below left), while David Scott remained at Command Module controls. The "what-is-it?" photo below right happens to be the state of Mississippi -- one of a special series taken by the astronauts as part of an added photographic assignment.



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. . . that the world's smallest monkeys—pigmy marmosets—are the size of mice, weigh a few ounces, are talkative, snippy.

. . . how computers are programmed to draw pictures? How sketches like the one here, drawn by an electronic brain in London, was a key tool in solving problems in a study of human factors?

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ANTARCTICA'S ICE CAP IS GROWING at an estimated rate of about one inch per year, according to first studies of data gathered by Dr. Colin Bull of Ohio State University. The polar continent contains 90% of the world's ice -- 7 million cubic miles of it. Up until now, no one really knew if it were coming or going. Dr. Bull's studies this past season will provide the first hard data.

SECRETS OF DISEASE IMMUNITY MAY SOON REVEAL THEMSELVES, thanks to the unravelling of the structure of the substance that fights invaders of the body. A team of scientists, led by Dr. Gerald Edelman at Rockefeller University, have just announced the successful deciphering of gamma globulin, and construction of a model of the complex protein, which is made up of 19,996 atoms, grouped in 1,320 amino acid building blocks. Knowledge of the structure will lead to advances in immunology and tissue rejection -- highly significant for organ transplant progress.

POLAR BEARS ALMOST HIBERNATE, according to findings of Dr. G. E. Folk of the University of Iowa. This settles an old debate. Some scientists thought they did; others that they didn't. Dr. Folk's research showed the male polar bear went into a state of suspended animation during winter night sleeps -- with a pulse of eight beats per minute. In summer it's 40 or better.

A NEW PLANET MAY HAVE BEEN DISCOVERED, if recent observations at Swarthmore College, Pa., are correct. Scientists at Sproul Observatory have deduced the presence of a "planet-like" body due to irregularities in the path of Barnard's Star, six light years away in another system. The new "planet" can't be seen, but is estimated to be larger than Jupiter.

THE HEAVIEST ELEMENT YET MADE BY MAN was synthesized recently at the Berkeley campus of the University of California. Two and possibly three forms of element No. 104 were synthesized. All of the isotopes of this element contain 104 protons. This determines the electric charge of the nucleus and the chemical properties of the atom. A Russian team of scientists had previously reported synthesizing another form of No. 104, but their claim has been seriously questioned by the International Union of Pure and Applied Chemistry.

Nuclear explosions:
can they really be made into useful tools?

Investigators, monitoring the fringes of areas where the Atomic Energy Commission is experimenting with peaceful uses for nuclear explosives, sounded a "radiation" alarm recently (Science Digest, Dec. 1967). Just how serious is it? What are the problems in harnessing the atom for the gigantic feats it can perform? How far have we come in putting nuclear energy to honest work? To find out, Science Digest asked Dr. Glenn T. Seaborg, Chairman of the U.S. Atomic Energy Commission, to spell out just what Operation Plowshare has achieved to date; what the researchers have learned; what advantages and disadvantages have turned up. The manuscript he submitted in response to our questions is printed herewith.—Editor.

by Dr. Glenn T. Seaborg

ALTHOUGH nuclear explosives were born as weapons of war, much recent research involving them has been centered on using their vast energy for useful and peaceful purposes. With them, we may one day build great canals to carry ships or bring water to arid regions and create vast harbors on forbidding coastlines. Explosions deep underground may aid in the recovery of natural resources—oil, gas and valuable ores. Such applications of nuclear energy are all under careful study today in the United States Atomic Energy Commission's Plowshare program.

Nuclear explosions are characterized by the extremely high temperatures and pressures associated with the nearly instantaneous release of large quantities of energy. The temperature is so extreme that all materials subjected to them have the properties of an ideal gas consisting of electrons and positive ions. These gases at high temperature and pressure expand rapidly in underground explosions giving rise to a pressure or "shock" wave in the surrounding rock. The gas continues to expand until the pressure is balanced by the weight and strength of the overlying

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2. Time = H + 2.8 sec.

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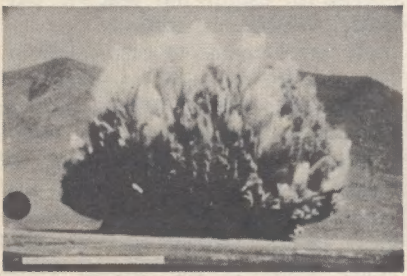

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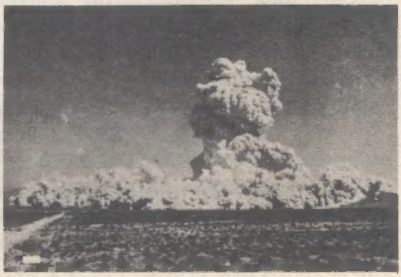


6. Time = H + 6 min.

The kind of nuclear explosions that may be useful for digging canals or roadways through mountains are shown above at various stages after detonation. These explosions dig out ditch-like craters. This one was buried at 637 feet beneath the desert surface. It had a 100-kiloton yield which is equal in energy to 100,000 tons of TNT. The major consideration with this kind of a nuclear explosion is radioactivity, but amounts can be predicted and controlled.

rock or until the ground surface is broken.

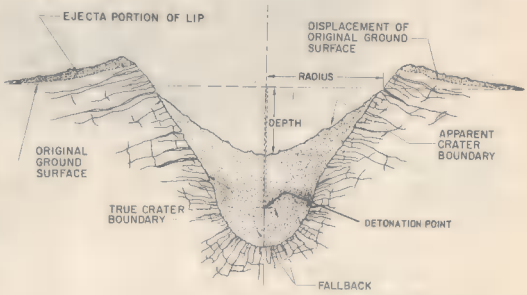
If the nuclear explosive is buried at an appropriate depth—neither too deep nor too shallow—maximum crater dimensions can be achieved. What happens is the pressure and shock wave cause the overlying rock to fracture and set it in motion. Then a rapidly expanding cavity pushes this rock and causes the surface to bulge upward. As cavity expansion continues, cracks and fissures are opened through the surface allowing the high pressure gas to escape. About half of the material originally above the explosion is thrown out to the sides; the remainder falls back into the cavity.

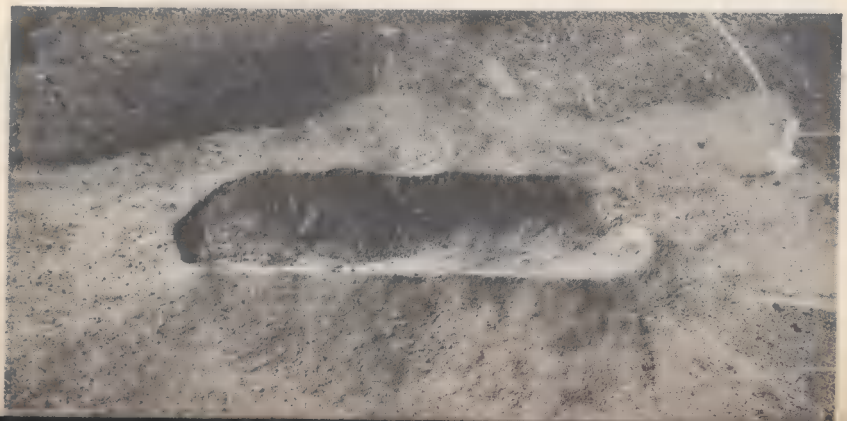
There has been limited experience with nuclear cratering; however, computers can accurately predict the outcome of the explosions—even the size of the craters. For example, U.S.

scientists have conducted an experiment involving the simultaneous detonation of five 1-kiloton nuclear explosives, to see if a linear crater with a smooth bottom and even sides could be produced. This was the first such experiment carried out by the United States using nuclear explosives. Information processed by computers was used to determine how deeply the explosives should be buried. The experiment was entirely successful, producing a smooth, ditch-like crater like the ones needed for digging canals or roadways through mountains.

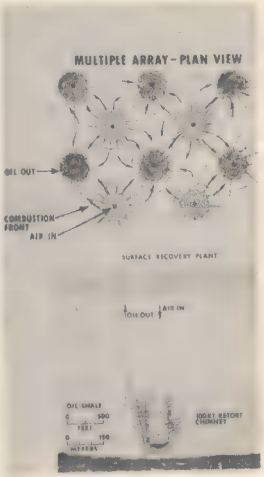
Radioactivity is an ever-present danger with nuclear explosions, but the amounts can be predicted and controlled using minimum-fission explosives which produce relatively little radioactivity. During a cratering explosion using such explosives, much of the radioactivity produced will be trapped in a puddle of glass formed by intense heat below the point of the explosion. Most of the remaining radioactivity will be scavenged by the earth and rock debris and will be buried in and nearby the crater. A small portion of the radioactivity produced will become attached to dust particles in the air and will fall to earth as the wind moves the air mass away from the crater during the first few hours after the explosion. Small traces of the radioactivity remain airborne for a longer period and are so widely dispersed by the wind and decreased by decay that they are well below applicable health standards after travel-

This drawing shows the typical result of a cratering explosion like the one on the opposite page. Craters of this kind are usually about 325 feet deep with a radius of 600 feet and a volume of over 176,550,000 cubic feet. The crater below is several thousand feet wide. The white arrow to the right points to a standard-sized pick-up truck—this will convey some idea of the vastness of the craters produced by underground explosions used in excavation projects.





At the site for the first underground nuclear explosion of the AEC's Project Gasbuggy, San Juan Basin in Northwestern New Mexico, scientists and workmen get set to emplant a powerful nuclear explosive with a yield of about 26 kilotons, 4,240 feet underground. The object of the experiment was to see if natural gas could be stimulated and ultimately recovered by underground nuclear explosions.



Underground nuclear explosions may be the secret to liberating vast amounts of trapped underground oil. Oil shale, a fine-grained rock, yields oil when it is heated to 350° C. The heat causes a solid hydrocarbon called kerogen to decompose. By breaking up the shale in place with explosions, the oil could then be recovered.

ing a few miles from the crater and practically unmeasurable after a day or two.

A major consideration in any construction project is cost. Strictly as a large energy source, there is nothing cheaper than nuclear explosives. A 2-megaton nuclear explosive might be as much as 100 times cheaper on a cost per-ton basis than TNT.

An indirect economic advantage of nuclear explosives is their compactness. A 2-megaton nuclear explosive can be emplaced in a drilled hole a little over four feet in diameter and would weigh perhaps a few tons. It would take several tens of thousands of cubic feet of chemical explosives weighing two million tons to duplicate the nuclear explosions. The production, logistics and emplacement construction problems of such large amounts of chemical explosives are unimaginable.

There are many safety considerations involved in nuclear excavation. Exposure of people to the radioactivity must be controlled so that no person is subjected to any hazardous amount. This requires an area free of population, at least temporarily, and wind conditions that would retain the radioactivity in a controlled area. Under these conditions the radioactivity problem is manageable.

Another limitation is the seismic

The typical chimney produced by an underground nuclear explosion is shown above. In this particular case, the chimney is used in recovering shale oil. These formations are produced when the explosion causes the surrounding rock to melt, vaporize or crack. The vaporized rock expands as a gas bubble which forms a cavity. Then as the rock lining the cavity cools, the roof of the cavity generally collapses and an almost cylindrical chimney of broken rock results. Vast amounts of natural resources may then be recoverable.

shock or violent earth tremors resulting from the explosion. To avoid damage to buildings or other structures from seismic motion, explosions must take place far away from built-up areas. A third limitation is the acoustic wave or "air blast" which can cause structural damage even at fairly distant locations where the acoustic waves may be focused by atmospheric conditions. Radioactivity, seismic shock and acoustic waves might seem to limit applications of peaceful nuclear explosions, but construction projects best suited to nuclear excavation techniques are generally located in sparsely populated areas.

Geography has played some tricks on man, forcing him to use long sea routes which would be vastly shorter but for a narrow ribbon of land such as the isthmus of Suez and the Isthmus of Panama. The Suez Canal required 10 years to build not quite 100 years ago. The Panama Canal also required 10 years to build, excluding a 9-year false start, and was opened nearly 54 years ago. The Panama required a complex lock system and was the engineering marvel of its time. Yet it is already becoming inadequate. A sea-level canal, with no locks, wide enough and deep enough to permit two-way traffic for the largest ships, would solve the problem. Such a solution may be possible using peaceful nuclear explosions. Preliminary studies indicate that such a gigantic construction project might be accomplished in as little as three years at a cost possibly less than one billion dollars.

A similar approach might be considered to transport water from a water-rich region to an area of dry wasteland by canals constructed using peaceful nuclear explosions. Some dry areas of the world are dry only because there is no way to retain the rainfall. Large lined craters might be used to retain this water for irrigation. In other water-poor areas where rainfall quickly runs off as surface water, dams might be constructed. These dams could be built by using the lip of a crater, by blasting a part of a canyon wall into a canyon floor, or by using a nuclear explosive deeply buried at a nearby site to break rock that could then be used for conventional dam construction.

In many areas of the world, there are potentially rich natural resources

which remain relatively untouched because of the high costs of transporting them to market. Nuclear explosions might be used to create harbors to make ocean shipping possible allowing the population to exploit the available resources.

Excavation, however, is just one of the peaceful uses for nuclear explosions. Equally important are the various uses envisioned for explosions deep underground, explosions which do not produce craters.

In less than one millionth of a second following the detonation of a 100-kiloton explosive buried at a depth of 3,000 feet, the total energy is released. A strong spherical shock front moves outward vaporizing, melting, crushing, displacing and cracking the rock. Most of the energy of the shock wave is deposited locally in the form of heat. The rock vaporized by the shock wave expands as a gas bubble forming a cavity until the gas pressure is approximately balanced by the overlying rock pressure. Cavity growth stops at a radius of about 150 feet. At this time, the cavity is lined with about 60,000 metric tons of molten rock and the cavity gas temperature is a few thousand degrees C.

The cavity may persist as vapors condense, temperatures and pressures drop and a molten puddle collects at the cavity base. But then, under most circumstances, the roof of the cavity collapses to form a nearly cylindrical "chimney" of broken rock. This chimney and surrounding fractures are potentially useful.

For example, much of the worlds' supply of petroleum, natural gas, shale oil and bitumen will not be recovered unless significant technological progress is made in production techniques. Nuclear explosions may recover these lost natural resources.

Project Gasbuggy is the first joint government-industry experiment in the Plowshare program to study the feasibility of using an underground nuclear explosion to stimulate production and increase ultimate recovery of natural gas by enlarging the effective radius of the well bore—the nuclear chimney. The experiment involved the detonation of a nuclear explosive with a yield of about 26 kilotons, 4,240 feet underground in the San Juan Basin in New Mexico.

Preliminary results of the December 10, 1967, explosion indicate that the first phase of the project, which consisted of creating a chimney of broken rock deep underground, was completed satisfactorily and safely.

The chimney is expected to have a diameter of 160 feet and to be about 350 feet high. The force of the explosion also caused lateral fracturing of the rock for about 430 feet on either side of the detonation point. Thus, the total fracture zone is estimated to have a diameter of about 860 feet with vertical fractures, including the chimney, totaling about 430 feet from top to bottom.

Nitroglycerin was formerly used in the San Juan Basin to stimulate the production of gas wells. Single detonations involving 950 to 2,400 liters of the explosive were employed. By comparison, the Project Gasbuggy explosion equaled the energy of about 12 million liters of nitroglycerin. It's expected that seven times more natural gas may be recovered with nuclear explosives as with conventional methods.

Similar methods would be used in tapping oil reservoirs as well as obtaining oil from oil shale—a fine

Nuclear explosions began as weapons of war, but science is dreaming of peaceful uses.

grained rock containing a solid hydrocarbon called kerogen. When kerogen is heated above 350°, it decomposes into various gaseous and liquid hydrocarbons and a carbonaceous residue. Retorting (heating) has been used for more than a century to produce oil from oil shale. Shale oil is now produced commercially and in small quantities only in the Soviet Union and China.

Oil shale could be broken up in place by means of nuclear explosions. This would create a chimney of very permeable fragments of oil shale surrounded by the relatively impermeable shale. This chimney could be heated in place, liberating the shale oil.

Besides offering the possibility of making billions of barrels of oil commercially recoverable, using underground nuclear explosions to extract the oil without bringing the shale to the surface would minimize disturbance of the natural landscape and also avoid water pollution and ash disposal problems.

There are now even proposals for storing oil and natural gas in porous and impermeable rock chimneys formed by underground nuclear explosions. Such storage cavities could be created in special locations such as beneath the ocean floor in areas of offshore oil production or in areas where ice limits tanker shipments.

Nuclear explosions may also be useful in mineral mining. The greatest potential for the deep underground explosions is in large, massive, regularly-shaped ore bodies too deeply buried for open-pit mining.

The copper in many large low-grade and small high-grade deposits cannot be economically recovered by conventional methods because the value of the copper content of the deposits is less than the cost of recovery. The large low-grade deposits are suitable for nuclear fracturing. Fracturing of such deposits would permit circulation of dissolving solutions through the rock, and recovery of the copper at a cost estimated to be less than conventional methods.

The rubble-filled chimney formed by a nuclear explosion might be used to develop and manage ground water. The voids within the chimney would provide storage space for water equivalent to about 400 million cubic feet per kiloton of explosive yield. This space, if created in rocks of low porosity and permeability, could be used for storage of water in arid regions, certain oceanic islands and permafrost regions. The loss of water by evaporation that occurs in surface reservoirs would be eliminated. Another use of nuclear chimneys would be for disposal of various types of liquid waste.

There is much yet to be learned about nuclear explosions, but the technology and understanding of peaceful nuclear explosions has advanced to the state where they can be safely, efficiently and beneficially used for earthmoving and for recovering natural resources.

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The sky is falling— but don't duck

Doomsday prophets, paranoiacs with delusions of astronomical disaster, and people with other bizarre outlooks, have been starting panics for centuries. Even as recently as last summer Icarus prompted wild rumors.

by Daniel Cohen

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THE STRANGEST RUMORS of catastrophe are floating around San Francisco these days," reported the *San Francisco Chronicle* last June:

"A planet is about to hit the earth, the rumors say; a heavenly body of huge proportions and mysterious origin is passing close to us—so close that the coasts of the continents will sink, the lost island of Atlantis will rise and all of California will be inundated by a tidal wave rivaling the Flood."

Some Hippies even made a pilgrimage to the mountains around Denver, Colo., saying they were looking for a "safe refuge" from the onrushing missile of destruction.

What had happened were doomsday rumors from two entirely different sources that had converged to form one grand Armageddon scare. The "mysterious planet" was nothing more than a pumped up version of little Icarus, a mile-wide asteroid that passed about four million

miles from earth last June 15. (*Science Digest*, June 1968; October 1967).

Scientists never thought Icarus was going to hit the earth. In fact, there was nothing unusual about last year's near pass of Icarus. It comes fairly close to earth every 19 years. In the past bigger asteroids have been closer than Icarus was in 1968.

In 1857 someone decided that this is what a catastrophic encounter would look like.

The origin of the Icarus scare was innocent enough. In 1965 Dr. Robert S. Richardson, formerly of the Mount Wilson Observatory in California, wrote an article about the asteroid. In it he said: "A change of only a few degrees in the position of the descending node of Icarus' orbit, the point at which the asteroid crosses the plane of the earth's orbit from north to south, would make it possible for Icarus and the earth to be at the same place in space at the same time." Dr. Richardson was speculating, not predicting. He called a collision a "remote possibility" and he certainly did not say that Icarus was going to hit the earth on June 15, 1968. But he had said enough to start the fanatics and prophets off on a field day of happy horrors.

The Icarus scare was helped considerably by a hoax perpetrated in Rome. Some joker managed to publicize a false story that the Vatican Observatory was trying to calculate the exact spot where the asteroid would hit. The story was denied immediately by the Vatican Observatory, and astronomers everywhere shouted in chorus that Icarus was *not* going to hit the earth—but it was too late.

Letters, telegrams and phone calls from frightened or angry persons poured into newspapers, magazines, universities and astronomical observatories. Many callers refused to believe assurances that the earth was in no danger. They insisted that a cam-

Prophecies of hard times—war, famine and plague—were made by an astronomer before the Thirty Years War which began in 1618. He saw it all, he said, in the constellations which forecast extreme hardship.

paign of silence had been instigated to keep the news from the people. Even a member of Britain's House of Commons asked his government to confirm or deny the existence of such a cover-up.

June 15 came and went. Icarus whizzed by and only the astronomers at their telescopes saw it, for the little asteroid was never close enough to be seen with the naked eye.

If Icarus had struck the earth it *would* have been a catastrophe. But it would not necessarily have innundated California in a tidal wave and it certainly would not have brought the legendary "lost island of Atlantis" popping up from beneath the waves.

The Atlantis part of the rumor came from a different source. It began in the 1930s and 40s with Edgar Cayce, a mystic healer who operated out of Virginia Beach, Va. People would come to Cayce with their medical problems. He would lie down on a couch and presumably fall asleep. While "asleep" he would diagnose his patient's illness and prescribe a treatment.

During these sessions Cayce would often ramble on about many non-medical subjects. One of his favorites was Atlantis. In December 1943, Cayce predicted that Atlantis would rise again. He set no exact date for the event, and since he made his prophecies in obscure language it is difficult to figure out what he meant. The key phrase is ". . . in Atlantis in the period of the first upheavals and destruction that came to the land, and must in the next generation come to other land."

Cayce followers have interpreted this statement to mean that destructive upheavals associated with the rising of the lost Atlantic continent will take place within the generation following the time the prediction was made. A generation is 33 years, therefore the "destruction" was pegged, by true believers, to take place before the end of 1976.

But in his mass of confusing predictions concerning Atlantis, Cayce gave some other dates: "Poseidia will be among the first portions of Atlantis to rise again—expect it in '68 and '69—not so far away." So if Atlantis is going to start rising and playing havoc with the rest of the world, it had better start doing it this year.

The details of the disaster can be glimpsed in other Cayce predictions:

"The greater portion of Japan must go into the sea.

"The greater change, as we will find, in America, will be the North Atlantic Seaboard. Watch New York! . . . Portions of the now east coast of New York, or New York City itself, will in the main disappear . . . ."

Cayce died in obscurity in 1945. But since that time his fame has grown. In 1967 he was the subject of a best-selling biography. Scores of paperback books about him and his predictions have flooded the market. A popular mystic organization called the Association for Research and Enlightenment had been founded by the Cayce children to spread their father's teachings.

The result of all this was that a lot of people thought that Atlantis would rise during 1968. Many also thought Icarus was going to hit the earth—so the whole foolish, but surprisingly widespread scare began.

Icarus is safely out of the way now, but the Atlantis rumors are still with us. Indeed, the rumors already are flying that portions of Atlantis have been sighted.

A group of amateur archaeologists who call themselves Marine Archaeological Research Society (MARS for short) say that they have spotted the remains of what appears to be an ancient temple in the Grand Bahama Bank, a shallow area off the island of Bimini. The Atlantis crowd has leaped at this scrap of information and has claimed it as "proof" of their pet theory. Just what Atlantis is doing off Bimini is not clear.

Actually, there is nothing new or remarkable about all this sort of metaphysical nonsense. Buried not too deeply in all our subconscious minds is the fear that the world may one day come to a catastrophic end. In one form or another, Armageddon and the Day of Judgment are integral parts of most religions. Any unusual natural phenomena has invariably set off rumors of doomsday. Galactic phenomena like comets and eclipses almost always produce hideous disaster rumors. Everywhere, rumors flew that atom bomb fallout was changing weather. Even earthquakes and volcanoes arouse fears of doom for mankind.

On February 8, 1761, London experienced a mild earthquake. Several chimneys in the Limehouse district were thrown down. Exactly one month later, on March 8th, the city again rumbled under a mild earth tremor.

Earthquakes are rare in London. Two earthquakes coming exactly one month apart was such an unusual event that it became a general topic of conversation. A weak-minded soldier in the Life-Guards named Bell became obsessed with the idea that there would be another earthquake the following month, and this one would destroy London. Bell took to running about the city predicting its destruction. He was so confused that he even got the dates mixed up and was predicting that the earthquake would hit on the fifth of April.

Poor Bell was obviously raving mad. No one took him seriously, until about a week before the rumored disaster. Then thousands of people began streaming out of London. They paid exorbitant prices to innkeepers of surrounding villages in order to secure a safe retreat. Those who did not have the money to get rooms simply camped in the fields.

Halley's comet was last seen in 1910, and with its appearance came countless doomsday rumors. This drawing by Fodestrum depicts Halley's comet's last appearance in 1910. Comets, until recent times, have been a prime cause of doomsday predictions, because they were once thought to be an unfavorable sign from the gods of impending disaster.

As April 5, 1761, came and went and London had still not been reduced to dust, most of the refugees returned. But some felt it more prudent to stay out of the city for a week or more—just to make sure.

For his warning the unfortunate Bell was given a suitable reward—he was thrown into a lunatic asylum. One suspects that some of the people who believed him should have joined him there.

Comets are one of nature's most awesome phenomena. Long ago men believed a comet was a sign from the gods that something awful was about to happen. The appearance of a comet in the sky would send people into the streets shrieking in terror.

Later man learned about comets. A comet was no longer regarded as a sign from the gods. It was recognized as a heavenly body rushing through the solar system at great speed. Unfortunately many people then assumed that the comet was rushing straight toward the earth, and the collision would smash the earth to atoms. Thus the comet was changed from a sign of destruction to an agent of destruction.

The aura of destruction which surrounds comets has persisted until fairly recent times. In 1832 astronomers predicted the appearance of a comet. Many people jumped to the conclusion that the astronomers had predicted that the comet would hit the earth. The alarm was particularly great in Germany where thousands of persons refrained from making any long term business deals during the year for they assumed that they would not live to see the deal through.

In 1910 when Halley's comet last appeared there was a rush of doomsday rumors—although the earth was not in the slightest danger.

A conjunction of the planets is not visually impressive. Several of the planets appear to be in the same place at the same time. Actually they are still billions of miles apart. But even so a conjunction is a unique astronomical event and many people believe that any unique astronomical event portends disaster.

In the year 1186 there was a conjunction of five planets. Several years earlier a man known as John of Toledo, using sound astronomical methods, was able to predict this conjunction. Unfortunately John did not stop there. He went on to predict that since the conjunction would take

place under the sign of Libra, the world would be struck by severe storms and earthquakes. (For reasons known only to themselves, astrologers classify Libra, the scales, as a "stormy" sign.)

The rumors of impending doom spread. In England the Archbishop of Canterbury proclaimed a time of fasting and prayer. In Constantinople the Emperor had the windows of his palace boarded up against the storms. And in Germany people barricaded themselves in cellars and caves to escape the ravages of the earthquakes.

In 1952 a similar conjunction of the planets provoked a flurry of end-of-the-world rumors among Oriental astrologers. Western astrologers who are more sophisticated and more cheerful failed to predict such a calamitous event. But they did hint rather vaguely that "something" was going to happen.

Eclipses of sun and moon have produced some madcap reactions throughout history. An eclipse of the sun occurred just as Alexander the Great was preparing to engage in a major battle. The event spread panic among Alexander's troops. Alexander was no less superstitious than his men, but he was also a monumental egotist. He interpreted the eclipse as a sign of doom for his enemies rather than himself. His confidence was so sublime that he inspired his army and the next day he won a smashing victory over his enemies who had been profoundly depressed by the eclipse.

Another optimist was the Athenian soldier Nikias. In 415 B.C., Nikias commanded an Athenian expedition against Syracuse. The campaign went badly and Nikias was at the point of retreating when an eclipse of the moon occurred. He decided this was a good omen and delayed his retreat. As a result he lost both his army and his life.

Perhaps the greatest epidemic of end-of-the-world terror ever known began during the year A.D. 999. Many people had become convinced that the world would come to an end a millenium after the birth of Christ —in the year A.D. 1000. The official Church tried to discourage the delusion, but to no avail.

People left their homes and families to join the ever growing throng of pilgrims heading for Jerusalem. They assumed that the Holy Land would be a good place to await the end of the world. As they traveled eastward, praying and singing, they kept their eyes on the sky, which they expected to open up at any moment. A thunderstorm or meteor would send the whole column onto their knees in terror.

What of our fate in the light of cosmic events? Presuming we get through the year without losing New York or Japan, don't expect the doomsday rumors to die out. Cayce and many other prophets predict that really awful things are going to happen by the year 2000. Unless the human race gets a lot smarter, we are going to keep hearing these rumors for the next 31 years at least. The world will always have its "Chicken Littles" to cackle and crow about the sky falling down on all our heads.

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ICHTHYOLOGY

Here come those crazy grunion

by Duane Valentry

THERE it is—a beach covered with fish, writhing, jumping, squirming—very much alive. A first look at grunion performing their crazy egg-laying ritual high on the beaches of California usually has you thinking you are seeing things.

What fish with a grain of fish-sense would choose to get itself high and dry for any reason at all? Grunion choose to do just this and because they do, many of them wind up in the frying pan.

But the grunion does know what it is doing, and what it is doing can only be listed under sea wonders. To follow the trail of the small silver fish, you'd need to tag one far out at sea where it first gets the idea to head for land.

Somewhere the grunion carries a biological clock. According to this concealed clock, it knows exactly when it's time to rush the beach. Now the famed "grunion run" is on, and unbeknownst to the fish, so strong is this urge to land, thousands of people line the beaches, waiting.

"Grunion Will Open 4-Night Run Friday," or some such notice will have appeared in local newspapers, alerting grunion-fanciers to the spectacular spawning run. Thousands are lured to this show put on by nature; many to look, more to "fish."

During the four four-night runs in June and July—the whole spawning season lasts from late February to July and August—though the fish on the beach are more or less helpless, fewer are caught than might be imagined. Grunion are illusive because they must be caught only with the hands and that isn't always easy.

In order to make sure grunion won't become extinct, California fish and game officials ban the taking of the fish during April and May.

When they come, they come exactly on time—sometimes. But then they may choose a beach tonight other than the one where you are waiting, shivering in the cold, damp sand. Then, again, apparently just to be perverse, it seems as if they set their watches off by an hour.

Considered a table delicacy, this member of the silversides family *Atherinidae*, is related to the smelt. Other members of the family include the Mexican grunion, jacksmelt and topsmelt.

The female grunion can be blamed if a pair lands in a frying pan, since she starts it all. She is also the particular one, insisting that only such and such a beach will do—and she makes the decision far out at sea. The male goes along too, floating in with her on just the right wave. Finally, they're left high and dry on a beach—hopefully one that fish-hungry humans haven't ambushed.

The female lays her eggs deep in the sand—first digging down into it—this is the squirming going on—until her body is almost entirely buried. Struggling up out of the wet sand, she tells the male to get a move on as he fertilizes the eggs and is ready to leave on the next high wave.

The wave comes smashing in and, barring other incidents like being caught, the pair is on their way to sea again. The whole miracle has taken half a minute, exactly.

The eggs lie safely buried. So safe, in fact, that even the sharp gull eyes far above cannot see them, nor can the poking beaks of sandpipers root them out. Safe, too, from the footsteps of beach walkers.

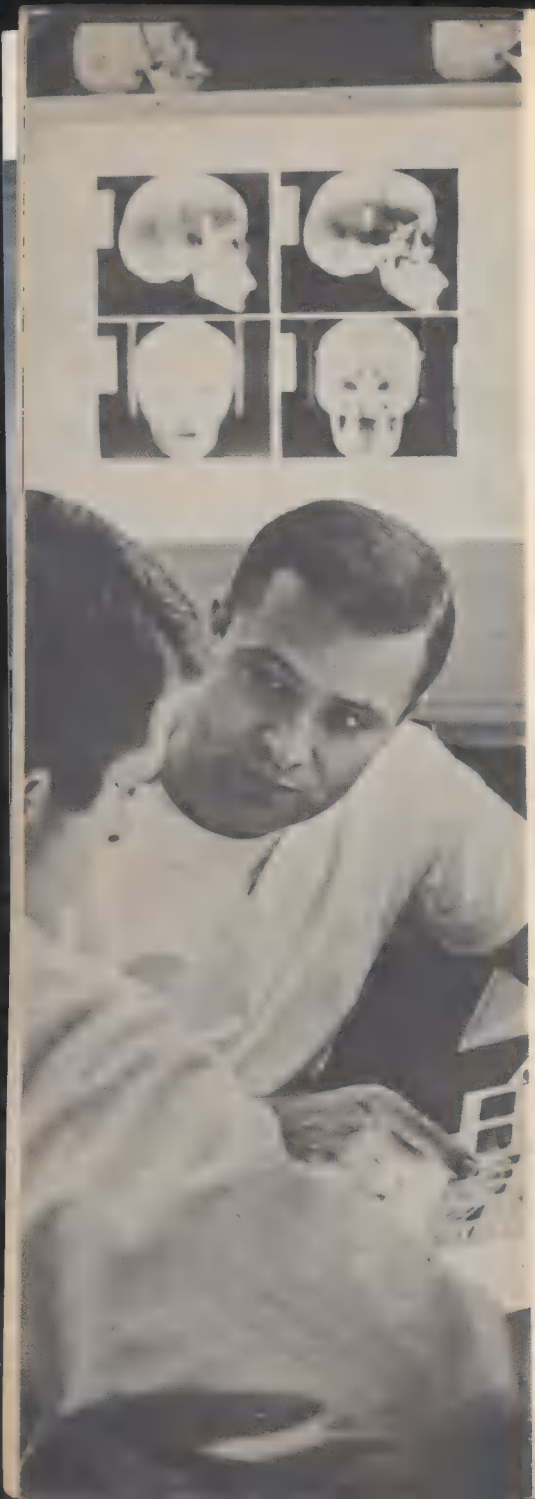
There in the wet sand the grunion egg pod will contain as many as 1,500 to 3,500 eggs.

Moons come and go, a few at least, and high tides again sweep up on the shore. *This* wave, *this* time, will wash away the sand and let the eggs roll up, each ready now to break open and pop out a baby grunion fit for sea travel.

Though it has gained international fame, the whole tale is so "fishy" some believe they don't actually exist.

A fishing license is required of anyone over 16 years of age, and the six- to seven-inch silversides, which appear to dance as they dig out their claim in the sand, are found from Morro Bay south to Abreojos Point in Baja California (Mexico). Popular grunion beaches are Pismo Beach, Santa Barbara, Ventura, Malibu, Santa Monica, Venice, Hermosa, Manhattan Beach, Long Beach, La Jolla.

Usually grunion come up for spawning or catching late in the evening, and many a hopeful fish catcher has put in a long cold night of watching, the schedule given in the newspapers clutched in a damp hand. It's not that the grunion are wrong, it just may be that they aren't so dumb as people think and that they have some fish instinct or other going for them.



Your teeth are here to stay

by Andrew Hamilton

POKING AROUND in the mouth isn't as glamorous as developing a polio vaccine, performing a heart transplant or shooting astronauts to the moon. So you may have to put up a while longer with jaw-swollen toothaches and painfully-tender gums. But amazing new developments in dental research will make you happier and healthier during the 1970s.

Since the establishment of the National Institute of Dental Research at Bethesda, Md., two decades ago, steady progress has been made in alleviating ailments of the mouth—sometimes called "a disaster area."

In 1948, NIDR operated on an annual budget of $229,000 and with a handful of researchers. Today, the budget is up to $30,000,000 with more than 100 full-time professional investigators—plus another 250 being trained as graduate students and post-doctoral fellows. Scientists from 30 academic disciplines are working on problems of the mouth and teeth.

"The technological and biological revolution is finally coming to dentistry," says Dr. Herbert Wells of Harvard.

Here are 10 areas of discovery about your teeth that will enable more people to retain a full set of teeth throughout their lifetime.

1. Fewer cavities. Approximately

The mouth—often called a disaster area—may get a clean bill of health yet. Technological revolutions in dentistry have uncovered 10 areas of prevention and treatment that may put an end to agonizing and costly repairs and help you keep your own set of teeth forever.

95 percent of all Americans suffer tooth decay. Roughly, there are one billion dental cavities in the U.S.—averaging about five for each of our 190,000,000 heads afflicted with caries (death of bone or teeth). It would take our 100,000 dentists 25 years—working at top speed—to fill all these holes. Meanwhile, another bumper crop of cavities would have developed.

Dental research is trying to solve the problem in another way: *Prevention.*

Through animal research at NIDR, it has been established that cavities are caused by infectious and transmissible microorganisms. Several investigators, including Dr. Morris Wagner of Notre Dame University, are working on a vaccine to prevent cavities in the same way that we guard against measles or smallpox.

Meanwhile, fluorides in the water of 2500 U.S. communities and in the toothpaste of millions of people have reduced cavities by 60 to 70 percent. Stannous fluoride and monofluorphosphate seem to be the best preventives in toothpaste.

Experiments by Dr. Joseph C. Muhler of Indiana University indicate that zirconium fluoride may be even better. Zirconium—used to make fine china and the inside of reactor chambers—helps to create a hard, smooth surface on tooth enamel that cannot be penetrated by bacteria. Such a toothpaste is not yet on the market, but is expected soon.

In Rochester, N.Y., Drs. Eriberto Cueto and Michael Buonocore cut decay 86 percent by painting youngsters' teeth with plastic. Dr. Fred M. Johnston of Electro-Optical Systems in Pasadena, Calif., is using a laser beam to glaze the surfaces of teeth, thus sealing them from decay penetration.

2. **Reduced gum diseases.** The reason millions of Americans get their teeth cleaned is so that their dentists may remove tartar—a calcium-salt deposit that builds up between and at the base of teeth. Result: irritation of the gums.

In persons over 35, this irritation often produces gingivitis and pyorrhea—resulting in three times as much trouble as decay. Such gum diseases have caused 26,000,000 persons to lose their teeth and wear dentures.

Dental scientists, including Dr. Irving Glickman of the Tufts Dental School, believe that a pill or a medicinal chewing gum could alter the chemical composition of saliva and thus reduce both tartar and decay.

3. **Proper foods.** A well-balanced diet has long been prescribed for healthy teeth and gums. Now, new facts about the effect of food on teeth are emerging from dental laboratories.

For example, research has shown that not only tobacco but powdered coffee and tea are powerful stain

producers. The only preventive is immediate rinsing or brushing. It has also been found that such foods as candy, syrups and jellies not only contain sugar to etch holes in teeth, but help to form plaque—the so-called "film" on your teeth that provides a foothold for bacteria.

Some dental scientists say that we should reverse the order of our meals —dessert first. That being impractical, we should at least finish up with salad or fruit. These are "nature's toothbrushes," and tend to scour out the sugars in our mouths.

Dr. F. H. McClure of the National Institute for Dental Research recommends that phosphates be added to breakfast foods and deserts. This chemical compound, found in a wide variety of products ranging from fertilizer to baking soda, neutralizes the harmful effect of sugars.

4. **Proper brushing.** In spite of dentists' pleas, many Americans do a very poor job of brushing their teeth. Only one in four of us uses a toothbrush after dinner, one in seven after lunch and one in 30 after a snack. To maintain healthy teeth, a person should brush immediately after putting any food in his mouth —even a glass of milk or a handful of peanuts.

Some individuals brush only the front teeth and neglect those on the side and back. Others tend to brush so vigorously, or to use such a stiff brush, that they wear grooves in the enamel. Recently some dental researchers have advocated cleansing the inside of the entire mouth with a soft-bristled brush—something that can be done while reading or watching TV.

Several drug companies are marketing a "disclosing tablet," developed by Dr. Sumter Arnim at the University of Texas, that will indicate areas missed by brushing. The tablet turns those parts of the mouth that have not been properly cleaned a vivid pink.

5. **New repair material.** Dental researchers are looking for a synthetic, paint-on material to replace tooth enamel destroyed by bacterial action, accidental chipping or nervous grinding of the jaws. Such material must withstand sudden temperature fluctuations (from freezing to near-boiling), resist the corrosive action of mouth acids and harden under water.

A promising clue seems to be the cementum manufactured by marine animals—such as barnacles—to attach themselves to ships' hulls. Another interesting possibility: materials developed in space research.

At New York University's College of Dentistry, Dr. Edward G. Kaufman is experimenting with maraging steel—a super-strength, lightweight alloy created for space rockets and deepsea diving craft—to make dental crowns, bridges and other structures.

Weak or wobbly teeth have long been pinned to roots of other teeth, but the newest thing is a "screw in" pin of gold or stainless steel that threads into a tiny drilled hole. One woman patient, whose mouth would not stand regular dentures, now has 16 artificial teeth pinned to the roots with these gold dowels.

6. **Implants.** Although they don't yet have the final answer, dental scientists are doing some extremely interesting research these days with implants—moving living teeth from one socket to another.

X rays showed that one Chicago patient had two upper wisdom teeth

Mobile dental clinic is used as a teaching tool for dental students at the University of California at San Francisco, and to provide community service dental care. Here students are cleaning children's teeth. Four completely equipped dental units are contained in the traveling clinic.

on one side of his mouth, none on the other. The trouble was that one of the two wisdom teeth was high in his jaw and had not descended. A dental surgeon switched the descended tooth into the hole on the opposite side of the patient's mouth. Then he coaxed the undescended tooth into place.

In other experiments, wisdom teeth encapsulated in individual "buds" have been implanted in an area where a molar was missing—later emerging as strong, healthy, useful teeth.

A way to irradiate extracted teeth has been suggested, which may lead to the establishment of "tooth banks." Children's teeth, removed in orthodontic procedures, have been stored for future use. This is only one step from removing teeth from cadavers for use by the living.

7. **Plastic teeth.** Teeth knocked out of a person's head—in a football game or in an automobile accident—can be cleaned, sterilized and put back in their sockets. About 80 percent of the time they firm up and become usable once again. One California mother found the tooth of her son at the bottom of the family swimming pool 48 hours after a diving board mishap. It was successfully re-implanted.

More promising are plastic or porcelain teeth—although completely satisfactory artificial teeth are not yet available. One of the most interesting experiments in this regard is taking place at Brown University, where Dr. Milton Hodosh and his associates have implanted plastic teeth in baboons. The animals chewed on coconut husks and the steel bars of their cages, but the plastic teeth lasted up to six years.

8. **Better bite.** Considerable attention is being paid these days to occlusion—the way your teeth come together when you bite. Good occlusion is important not only for cosmetic reasons but for good health. When teeth are not meshing properly,

gingivitis can set in and you may lose them. A poor bite can also lead to referred pain in the ears, neck or back.

Improper occlusion can be corrected by orthodontic procedures, surgery or selective grinding of the teeth. Sometimes a dentist has to change a patient's habits. Chewing on a pencil, sleeping on one side only, leaning the face on one hand while reading—all these actions can throw teeth out of line.

Tongue may be a culprit

A serious problem with some people is "thrusting" teeth out of position with the tongue. One woman came into the UCLA dental clinic complaining she could not eat artichokes any more; her front teeth leaned so far forward that she had no bite at all. Her tongue had literally pushed her teeth out of line. She had to be re-educated in how to swallow.

9. **Near-painless dentistry.** One reason so many people neglect their teeth is fear of pain in the dentist's chair. A few even become so worked up that they interpret the whirr and vibration of the dental drill as pain itself. New developments, however, have eliminated dental pain almost entirely.

High-speed, precision cutting tools with diamond or carbon steel heads that revolve up to 500,000 times a minute are now available. Water- and air-cooled, such drills can hardly be felt by the patient. Pneumatic injection of anesthetics has eliminated the needle in some cases.

Recently-developed anesthetics can pinpoint a local area, or block pain in a large area for half a day. A new process called "refrigeration anesthetic," developed at the U.S. Navy's dental school, is used where cementing a tooth cap prohibits the use of regular pain killers. This is simply the application of cold water until it reaches the near-freezing point. Then the dentist puts on the cap without any pain to the patient.

"The best anesthetic of all," says one researcher, "is confidence in your dentist."

10. **Disappearance of the dental chair.** Even the traditional dental chair, once as much a part of the American scene as a Model T Ford or the little red schoolhouse, is disappearing.

In its place is the contoured *chaise lounge*. This new dental couch can better accommodate the new "four-handed dentistry" in which a dentist and his skilled assistant can both work at the same time. Time spent by the patient in the chair can be reduced by 50 percent.

"Dentists of the future, such as we are now training, will be able to perform in all fields of dentistry," says Dr. Reider Sognnaes, dean of the School of Dentistry at UCLA. "They will be engineers, artists, psychologists, digestive experts, chemists and anestheticians.

"And dentistry itself is moving from a restorative, technique-oriented phase to a biologically-based health profession—one that emphasizes prevention and not just treatment of diseases."

For further reading

YOUR CHILDREN'S TEETH. *Theodore Berland and Dr. Alfred E. Seyler. Meredith Press. 1968.*

This bomb may go off

Three Lions Photograph

"HELLO, POLICE? I've just put a bomb in the bus station. It's timed to go off in 20 minutes." *Click.*

When a call like this comes into the Nassau County, New York, police switchboard, the department's Public Safety squad goes into instant action. Chances are the call is a hoax but the squad can't rely on the probabilities. Aided by a number of scientific detection tools, they check and re-check each possible hiding place in the designated spot.

Among the tools they use is a portable X ray machine that can develop its own film on the spot. Point it at a harmless-looking package wrapped in brown paper and string and it will quickly reveal the contents. Another device is an acoustic instrument so sensitive it can hear the most quiet mechanism of any electrical or mechanical clock.

If a bomb is detected, the Public Safety Squad is ready for it. Donning bulky protective "armor," a squad member sets about dismantling the device with a skill almost as delicate as a surgeon's. In this trade, his first mistake might be his last. Sometimes the area where the bomb is first discovered presents hazards for dismantling, so, if there's time, it's transported to a safer area aboard a "bomb truck." The truck has a roomy metal chamber for live bombs into which an armor-wearing squad member gingerly places the explosive device (see above) for its ride.

PSYCHOLOGY

Suburban isolation

Dr. Mechner: "Start your child in a baby box."

by Susan Strom

THE beribboned, beruffled bassinet, a delight to cooing grandmas, may become a relic of the past.

It already is in the Pleasantville, N.Y., home of Dr. and Mrs. Francis Mechner who have raised all three of their pre-school children in an advanced model of the "Skinner Box."

Dr. B. F. Skinner, behavioral psychologist at Harvard, invented the first transparent plastic box for his two children, now grown, to provide a freer environment than the ordinary barred baby crib offers. The box has heat and humidity controls.

No blankets, confining clothing—nothing except diapers—are needed. The baby can look out without obstructions and mom can look in. The child moves freely. A mattress, sort of a screen, wipes off easily. Because an evaporating unit is under the crib proper, urine seeps through the mattress and is dispelled without odor.

Mrs. Mechner, a lithe, long-haired

(continued on page 30)

controversy

Suburban mother: "A great idea—but why waste it on babies?"

by Mrs. Samuel Sterman

IT'S GOOD to think that because of people like Dr. and Mrs. Mechner, acceptance and popularity are coming to the "Skinner Box." It's a great idea—but why waste it on babies?

If today's behavioral psychologists want to make a real contribution to mankind, let them move the Skinner Box out of the nursery and enlarge it so that it can provide its serene, glassed-in comfort for other deserving members of the family.

How would it work? Simple. Two-year-old Jimmy is having a tantrum? Pop him into the box. Since the standard treatment for tantrums is calm removal from the scene of frustration and matter-of-fact acceptance of the storm, the box would be the perfect answer. Jimmy can howl and stomp his feet in safe sound-proof comfort and the rest of the family won't be disturbed by his performance. This is obviously much better

(continued on page 30)

"Start your child in a baby box."

(continued from page 28)

brunette, believes that babies raised in the box develop agility more quickly, walk, sit up and move at an earlier age than those who sleep in conventional cribs. And you don't have to worry about smothering—or draughts!

For those who shudder at the impersonality of raising a baby in a box, Mrs. Mechner says: "They don't like to stay in it very long." And a box is no excuse for giving up cuddling a child, Dr. Mechner says.

The "Air Crib," as Dr. Mechner prefers to call it, is just part of his philosophy of child raising and early childhood education. His Basic Systems was sold to Xerox, and now the young psychologist has started a firm to develop pre-school educational materials to be used by parents—in the home.

Right now, his main concern is helping parents to be *better* parents by making them more confident and by improving the quality of the time they spend with their children.

Both articles condensed from Patent Trader, a twice-weekly newspaper, Mt. Kisco, N. Y. *© 1968.*

"...but why waste it on babies?"

(continued from page 29)

for everyone than letting him thrash around on the kitchen floor.

Dad has a report to write or a complicated form to fill out? Reserve an hour's worth of box time for him after dinner.

Grandma can't keep track of the stitches in the ski sweater she's knitting? Into the box, where all distractions vanish in unapproachable privacy.

Bud wants to play his new bagpipe record at full volume? Put the record player inside the box and let him enjoy his own listening booth without endangering the sanity of the rest of the family.

And Mother? What better refuge on a dreary afternoon when the children are off at school and the baby is peacefully asleep in his old-fashioned crib? Mother can flop down for a few minutes of relaxation, no longer vulnerable to the demands of the world of doorbells and telephones.

Indeed the Skinner Box is a remarkable invention and an obvious boon—but why just for babies? What about the rest of us?

JUPITER IS A 600-FOOT RED JELLY BEAN
ST. PETER IS ALIVE AND WELL AND LIVING IN ARGENTINA
MAKE WINE NOT WAR!
DEMETRIUS DRINKS FROZEN DAIQUIRIS
TERPSICHORE HAS TWO LEFT FEET
MARK ANTONY IS A DRAFT DODGER
VENUS WEARS COMBAT BOOTS
CLEOPATRA, GO HOME!
JULIUS CÆSAR IS A DIRTY OLD MAN

The walls remember

WHEN SOVIET TANKS first rumbled into Prague, bitter quips appeared on the walls: "Russian circus in town. Don't feed the animals." One of the Red tanks sported (painted on its side by a daring Czech): "They're here. Take off your watches and hide your wives."

The Paris students who rebelled in May 1968, left quixotic thoughts on the walls of the Sorbonne: "Be realistic, ask the impossible." Or, "I have something to say, but I don't know what it is." Another rebellious student wrote, "God, I suspect you of being a left-wing intellectual."

There were *no* reports showing the literacy of the Columbia University rioters. But near Manhattan's other end, a hangout called Chumley's is widely known for the deadpan humor of its graffiti. A typical one might read, "My mother made me a psychopath," to which another hand has added: "Can she make me one, too? How much wool does she need?"

This is not unlike, in spirit, the writing on a wall in Pompeii: "Lovers, like bees, enjoy a life of honey,"

followed by someone else's comment, "Wishful thinking."

Hundreds of graffiti are preserved on the walls of Pompeii. Many were scratched only a few feet above the ground, undoubtedly by school children practicing their newly-learned skills. They left alphabets, including one by a young show-off who wrote the second half bacwkards, and in the interstices of the first part:

A X B V C T D S E R F
Q G P H O I N K M L

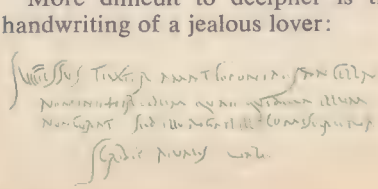
Rome had no J, U, W, Y and Z, but the order is the same as ours today.

Lovers immortalized their feelings "Figulus amat Idaiam" (Figulus loves Ida)—but also the opposite: "Serena Isidorum fastidit" (Serena hates Isidore). Some try for anonymity by writing backwards: "Sullimah Ethon sic amo," which ill conceals the thing that Hamillus has for Nothe.

Election posters boost Favorite Sons for office, as in this notice written large and legibly by a skilled hand:

"M. Holconium Priscum IIvir(um) i (ure) d(icundo) Pomari universi cum Helvio Vestali f(aciatis) rog (ant)"—or "The united fruitmen with Helvius Vestalis urge you to make Marcus Holconius Priscum duumvir with judiciary powers.

More difficult to decipher is the handwriting of a jealous lover:



"Successus textor amat caponiaes ancillam nomine Hiridem, quae quidem illum non curat. Sed ille rogat illa com(m) iseretur Scribit Rivalis. Vale." It means Successus the weaver loves the innkeeper's maid servant, Iris by name. She, however, does not return his love. But he begs her to take pity on him. Written by his rival. Good-bye.

Who knows, Iris may not have given a fig for either of them. But we do know that another young lady named Primigenia, a resident of Nuceria (a "suburb" of Pompeii) seems to have given her love generously—and left them sighing for more. No less than eight graffiti about her have survived on the walls of Pompeii:

"How happy we are to have known Primigenia"

"Good-bye Primigenia, keep well"

"Sabinus was here with Primigenia"

"By the Roman Gate at Nuceria you may seek out Novella Primigenia, in Venus Street"

"Primigenia, Primigenia, goodbye"

"Secundus with Primigenia met here"

"Cornelius sends the biggest possible bundle of good wishes to Primigenia"

"Welcome to Primigenia the sweetest and most darling of all the girls in the world, our best wishes."

Graffito No. 9 was found along the road to Naples:

"Good wishes to Primigenia of Nuceria"

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And on the wall of a tavern in Herculaneum:

"Hermeros wishes all the best to Lady Primigenia. Come to Puteoli and in the Timinian Street at the place of the banker Messius, ask for Hermeros freedman of Phoebus."

From what the walls remember, 'Genia certainly must have been quite a girl!

Frozen immortality?

Cryonics, freezing the dead in hopes of future reanimation (see *Science Digest*, June 1967) is still going strong. Ten more bodies have been placed in special freezing chambers in the past two years and live membership in cryonics groups is up to 1,000. The cryonics societies, whose motto is "Never say die," maintain facilities at Phoenix, on Long Island in New York and in California's Orange County. A new $100,000 facility that just opened in California has room for 40 bodies (they're called "patients") in stainless-steel vaults. Cryonic burial isn't cheap: the body of a New York University student who died last year is in a $4,500 capsule maintained at $50 a month. Science tends to scoff at cryonics, but members of cryonics groups don't care. Says one: "How many problems can you have that are worse than being dead?"

This bizarre-looking machine actually walks quadruped-style on monstrous aluminum legs. Lumbering along at five mph, it is controlled by both arms and legs of its operator. It's sensitive to any arm or leg movement and mimics whatever the man inside does. Developed at General Electric by Ralph S. Mosher, it is 11 feet high, weighs 3000 lbs.

Secrets of volcanoes

Volcano dust is present almost everywhere almost all the time, but scientists from the National Center for Atmospheric Research are just discovering its composition. Samples yield sulphuric acid, ammonia, sulphur and calcium and magnesium sulphates in different proportions from different volcanoes. Kilauea in the Hawaiian Islands ejects a material that is more than 95 percent sulphuric acid droplets. Dust from Mayon in the Philippines has much less acid and so does that from Arenal in Costa Rica. Surtsey, off Iceland, gives off particles of metallic

compounds unlike those from other volcanoes analyzed, perhaps because sea water has constant access to its vent. Volcano dust has been held responsible for ■ number of dips in world temperature in the past 200 years.

The ugly alligator

If an alligator looked as cute as a seal, the toothy reptile would have a much better chance of escaping extinction in the U.S. Canadian officials are seriously thinking of discontinuing their profitable annual harp seal hunt because of the embarrassing public furor over this year's grisly hunt, but just last year the U.S. Congress defeated a bill aimed at protecting endangered wildlife like the American alligator (*Alligator mississippiensis*). Currently, there are about 20,000 'gators left in the southeastern U.S., many of them in Florida's Everglades. Not too long ago, there were millions.

A Florida law protects the alligators but poachers kill them in the glades and sell the hides to buyers from the northern states, where they can be sold legally and profitably. Alligator hides bring poachers about $6 to $7 a foot; buyers get $20 to $30 a foot at factories where the hides are made into expensive shoes, bags, belts and luggage. The record length for an American alligator is 16 feet, but probably none of this length are left in the U.S. Even 12-foot alligators are almost unknown these days.

American alligators suffer particularly at the hands of poachers, because they're comparatively mild-tempered and easy to catch in spite of their formidable appearance. Raymond L. Ditmars describes in *Reptiles of the World* how he and another man overpowered a vigorous 12-foot specimen without much trouble. The American crocodile, which lives in Florida and is about the same size as the American alligator, is a considerably meaner beast. (One other difference between a crocodile and alligator: the crocodile has a much more pointed snout than the alligator.)

But help is on the way to the beleaguered American alligator. Secretary of the Interior Walter J. Hickel has announced that he's using $100,000 from current National Park Service funds in a stepped-up drive against alligator poachers in

Alligators aren't exactly beautiful, but their hides are highly valued by shoe and purse manufacturers. Poachers have just about wiped out the reptile, even though the law protects them.

American Museum of Natural History

the Everglades. As part of the campaign, four rangers in Everglades National Park are being assigned full-time to alligator protection and a conservation "possee" of long-time Everglades residents is being recruited to reinforce the rangers. The Nixon Administration is backing another bill to protect endangered wildlife this year.

Nose-printing cows flops

Differentiating one cow from another is quite a problem sometimes, so officials of Britain's Milk Marketing Board came up with a bright idea: nose-prints. The wrinkles on each cow's nose are different so nose-prints seemed like a foolproof method of identification. Unfortunately, it didn't work out. Cows' noses are wet and the printmakers couldn't dry them off long enough to get good prints. Their latest idea is nose-shots—photographs of cows' noses. A report on the success of the project is expected in a couple of years.

Porpoise to the rescue

Several hundred feet beneath the sea, an aquanaut is investigating the terrain for the possible erection of an underwater installation. Near him swim two large porpoises. Suddenly a large shark glides into view: The porpoises swim close to the aquanaut, facing the intruder. The shark retreats.

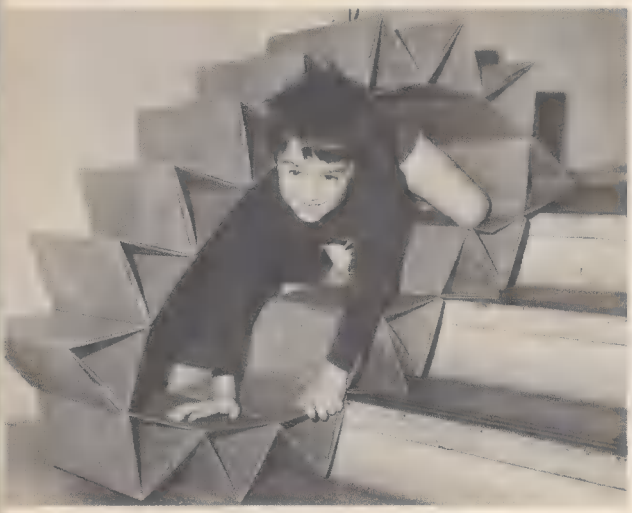
A scene like this might take place someday if porpoises can be trained to protect aquanauts and divers from dangerous sharks, says Forrest G. Wood of the Marine Bioscience Facility at Point Mugu, California. Porpoises sometimes attack sharks, and some porpoises, especially the Atlantic bottlenoses, have already been trained to work untethered in the open sea with men. The animals carry small packages and lines and locate and mark sites.

"Insofar as porpoises are concerned," Mr. Wood told the 1969 Underwater Technology Conference in Coronado, Calif., "the available evidence indicates that sharks will sometimes attack them, sometimes porpoises will attack sharks, and sometimes each will tolerate the presence of each other." Available evidence suggests, however, that sharks are more likely to be the aggressor. Porpoise remains are frequently found in the stomachs of large sharks. "This is not to say," he pointed out, "that a porpoise could not be trained to exhibit greater aggressiveness and provide some degree of protection to a diver."

Tripping with catnip

Cats apparently get quite a "trip" from catnip, according to the *Journal of the American Medical Association*. Four marijuana-smokers who tried smoking catnip regularly described their sensations as similar to those they got from marijuana. They smoked either the catnip leaves themselves or sprayed or injected tobacco with catnip extract, a method which seems to produce quicker, more intense results. Both forms of catnip are readily available in pet stores. Doctors comment that in two of the cases, states of altered consciousness and headache indicate that the effect of catnip may be more like that of LSD and thus potentially more serious than marijuana.

NEW FOR PEOPLE



Pictorial Parade

This British youngster is going downstairs in a toy called "Lunar Trek" introduced recently in Britain by Polypops Toys. As he shows, the vehicle's articulated caterpillar track enables the corrugated fiberboard design to revolve as the child moves forward. "Trek" will surmount most small obstacles in its path, according to its manufacturer. Sounds like just the thing that might wear out a lively lad on this side of the Atlantic Ocean as well.

Worried about landladies or the neighbors snooping through the contents of your wastebasket? With "Destroyit," your secrets will be safe. Feed a sheet of paper into Destroyit and before you can say, "Don't peek," it will be shredded into bits so small even Sherlock Holmes couldn't get them back together. If you're the type that drops an important paper into the wastebasket now and then, though, forget it. Manufactured by Electric Wastebasket Corporation, N.Y., N.Y., Destroyit works automatically, takes two to five sheets at a time and plugs into any electric outlet. Model shown here is just 11 inches high.

Light-beam control system (above) is enabling paralytics to type, turn on the radio and answer the telephone. It consists of a flashlight-like device worn on any part of the body capable of 5-degree movement, often the head, and a control panel. By moving the device slightly, the patient directs a beam at the panel, triggering photo-electric cells which activate appliances. Developed in Britain, it has a somewhat steep price—over $1,000.

An electronic calculator (above) is no bigger than a Polaroid camera and can be carried with ease by a secretary. It is being introduced here by Sharp Electronics Corp. of New Jersey. It scales just over three pounds. The tiny device can multiply or divide up to eight digits and will reel off four calculations within 0.3 seconds. Hayakawa Electric Company of Japan, which developed the miniature calculator, calls it an "electronic abacus."

A phone in the hand is worth two on the stand, at least when you want to be comfortable. This mini-phone, dubbed "Grillo," weighs just 15½ ounces and is 8½ inches long when unfolded. Folded, it measures less than 7 inches, much smaller than conventional phone. Its dial is in the middle, between the earpiece and the receiver. Grillo is compatible with all public and independent equipment, according to its manufacturers.

BIPS

Beware that

by Arthur S. Freese

WE LAUGH at the pictures of the pre-World War I woman with parasol, enormous hat, prudish swimming suit and her whole cover-up bit. Her world believed that much of a woman's beauty was a pale complexion. Yet this readily-fainting beauty had one-up on her modern sun-tanned, scantily-clothed counterpart, for pre-World War I woman was well protected from skin cancer.

Before the 1930s, most men worked outdoors and cultivated a deep rich suntan. It became a mark of distinction to be pale. But now this has come full circle, and most people work indoors. When this new work pattern began, a suntan became a status symbol—it indicated someone of wealth and position, for they were the only ones who were able to spend long hours on the golf course and beach, or take a vacation in Florida. This thinking has become part of America's folklore and has made the pursuit of a suntan ■ national aim.

This year, the American Cancer Society expects over 100,000 people to develop skin cancer, far more than those who will suffer from tumors of any other body organ. Some 5,000,000 people will also suffer from precancerous skin conditions. A precancerous condition is one which precedes the development of a cancer. With early diagnosis and treatment, at least 95 percent will be cured; nevertheless, 5,000 people will still die of this disease in 1968.

The skin is your largest organ, covering 20 square feet. It does a lot of work: it retains the necessary moisture in the body, protects the other structures, serves as an important sensory organ, gets rid of waste products and regulates body temperature. It consists of two layers—the outer epidermis and inner dermis.

The epidermis has no blood or

noonday sun

lymph vessels, but it does have nerve endings. Its cells last only some 27 days and never get old for they are replaced continuously throughout life. The outermost layer is called the stratum corneum and consists of dead cells which have slowly been pushed to the surface, changing and dying on the way.

The dermis or inner layer is dense and contains connective tissue fibers. When animal dermis is chemically processed, it becomes leather. This layer has blood vessels, nerve endings, hair follicles and skin glands. The muscles in the face and neck are inserted into the dermis in such a way that they make it possible for you to move your skin.

This complicated organ also protects your body from ultraviolet (UV) radiation which is actually energy just like X rays. Most of this energy is absorbed and harmlessly dissipated by the stratum corneum, but some penetrates into the dermis. The UV triggers photochemical and biochemical changes, and tanning is the normal response.

With constant heavy UV irradiation, the cells change and irregular pigment forms. The dermis undergoes a chemical alteration, and these chronic irreversible changes produce a leathery flabby skin with folds and wrinkles.

Constant tanning causes rapid and premature aging of the skin—this damage can even appear during the teens. Dr. John M. Knox, head of dermatology at Baylor University College of Medicine, Houston, Texas, says that it is the amount of sun and the susceptibility that determine skin damage and *not* the age.

Ultraviolet radiation produces actinic degeneration of the skin, "sailor's skin" or "farmer's skin"—a dry, leathery, wrinkled and pigmented skin.

Microscopic examination of unexposed skin, such as that you sit on,

shows no change with age. In Benjamin Franklin's day, women exposed their shoulders. Only recently has medical science proven the accuracy of Ben's comment that if you took a group of women and put barrels over their heads and shoulders, not even a careful observer could tell their age.

For nearly 75 years, doctors have known that the sun causes skin degeneration and cancer. Medical reports have repeatedly borne this out. For example, in 1957, Doctors F. D. Malkinson and S. Rothman of the University of Chicago found the 91.1 percent of skin tumors were on those parts of the body exposed to the sun. Locomotive engineers and truck drivers often develop the disease on their left cheek—the one that gets the sun when driving.

Mannequins as guinea pigs

Dr. Frederick Urbach, famous dermatologist of Temple University Medical School, Philadelphia, filled in the details of the connection between sun and skin cancer with his dye compound which changed from yellow to red wherever the ultraviolet rays struck it. He painted the face, head and neck of a set of hat-store mannequins with his yellow material and then gave the dummies sun baths—first on a roof and later at a public swimming pool. He showed that ultraviolet radiation was heaviest on the very areas that develop most skin cancer—the top of the head, tips of the ears, nose, upper lip and neck.

Dr. Urbach also proved that a beach umbrella actually reduces UV exposure by less than 50 percent, because the rays reach you from everywhere—by reflection from the ground or buildings or other objects, even more from the sky than from the sun itself. He also debunked two other common misbeliefs—water does not materially reflect UV rays; and water gives *no* protection, for these rays go straight through it.

Your sensitivity to UV radiation is an individual characteristic, but the color of your eyes and skin are usually good guides to your susceptibility to skin cancer. If you want to measure yourself, Doctors B. S. Mackie and V. J. McGovern have divided people into three types in predisposition to UV-induced skin cancer:

Type 1—The most susceptible person has fair skin and blue eyes. Australians, for example, have the highest rate of skin cancer in the world because of their Celtic origin, with its fair complexion, and their large number of outdoor occupations.

Type 2—The olive-skinned person with natural pigment in his skin is more immune, for he develops a tan easily and quickly, sometimes after only a hour or two of exposure.

Type 3—The Negro has nearly total protection and almost never gets skin cancer. In fact, all dark-skinned people have protection.

Dr. A. F. Hall is said to have suggested that the more brown eyes in your family tree, the safer you are from UV-caused skin cancer.

Your color is due to a natural pigment called melanin—this provides all the yellowish-brown, brown and black colors in man. It's found in the hair, skin, brain and the inner layers of the eye, accumulating as granules within the specialized cells which manufacture it. Small amounts of melanin produce a yellow or brown

"True, mad dogs and Englishmen go out in the noonday sun, but only the dogs get away with it."

color, large amounts in dense masses give a dark brown or ■ "black" color. Rarely do these melanin-forming cells become cancerous and these are only 1.3 percent of all tumors. Like all other cancers, the cells grow in wild fashion, choking out normal cells and spreading to different parts of the body (a process called metastasis). This uncommon skin cancer is called melanoma and is a serious tumor. It usually starts as a dark brown or black mole-like growth which enlarges and may become ulcerated or bleed.

Ultraviolet light is high energy radiation and is invisible to the naked eye. It is emitted by the hydrogen in the sun's inner atmosphere. The sun goes through periods of great disturbance when it emits tremendous amounts of UV radiation and X rays —the "solar flares" that threaten our space travelers.

True, mad dogs and Englishmen go out in the noonday sun, but only the dogs get away with it. UV radiation, like X rays, produces an insidious and cumulative damage. The cancerous and precancerous conditions UV causes are a continuous process, beginning with the first UV dose or shortly thereafter, although most of these tumors only appear after 50. This process begins in earliest childhood. The noonday sun is the worst offender, for it comes straight at you through the thinnest part of the atmosphere and so has the strongest UV radiation. Early or late in the day, or in the winter, the sun's rays come through a thicker layer of atmosphere which reduces the actinic rays. The closer you go to the equator, the stronger the radiation—Texas, for example, has the highest rate of skin cancer in the nation.

Additional confirmation of the cause of skin cancer comes from the National Cancer Institute where Dr. Harold F. Blum has shown that repeated doses of UV radiation will produce skin cancer in rats and mice.

What must *you* watch for? Undoubtedly you have the usual collection of moles, warts, birthmarks and bumps and marks on your skin. As long as they continue to live peacefully with you, they're nothing to worry about. But if they change —if they grow, become irritated, bleed or ulcerate—have a doctor look at them promptly. Skin cancer can also show as a dry scaly patch or pimple which does not disappear, or even as an inflamed area with a crust or a pale nodule which ulcerates.

What does the doctor do? That depends, of course, on what the problem is. In general, he will simply remove the skin cancer in any one of several painless ways and send at least some of it to the pathology laboratory for examination. He may remove it by curettage, electrosurgery, cryosurgery (surgery by ultracold), radium or some other method. It doesn't hurt and it's almost 100 percent effective. Both cancerous and precancerous skin conditions are treated the same and both are more common with advancing age and in men.

At a national seminar on cancer in

April 1967, Dr. Edmund Klein, chief of dermatology at Roswell Park Memorial Institute in Buffalo, N. Y., revealed two new methods for diagnosing and curing skin cancer—methods with major significance for the treatment of all tumors. He described his successful use of chemotherapeutic drugs; and how an allergic reaction could be tricked into curing cancer instead of producing the usual miseries, a revolutionary new approach to tumor treatment. He told how unrecognizable skin cancers can be made to turn red and reveal their presence before they could otherwise be seen.

With his new methods, Dr. Klein has obtained complete regressions in more than 5,000 cancerous and precancerous skin conditions, and for periods of up to five years. One method he devised was local chemotherapy—the anti-cancer drugs are put right on the condition as an ointment, cream, solution or injected directly into the growth. When it's absorbed, the drug becomes so diluted in the body that it does no harm. The chemical kills only the diseased cells without injuring the adjacent normal tissues. Although small growths are still best removed by surgery or radiation, this new chemotherapy can cure sizeable areas with little or no scarring.

Dr. Klein's other method is based on an entirely new principle which h e named immunotherapy. Using drugs which cause skin allergies, he applies them directly to the skin condition—the chemical i t s e l f does not kill the diseased cells, but the drug causes an allergic reaction of the body so that the body kills its own diseased tissue.

These two methods have offered, for the first time, a means for early detection of cancerous and precancerous conditions although it is only applicable, as yet, to the skin. When either method is used, the drug can be applied to apparently normal skin beyond the diseased area and any hidden cancerous or precancerous conditions will show themselves by turning red, and even eroding. With one chemotherapeutic drug, 5-Fluorouracil, regressions have occurred in more than 90 percent of the patients.

Nevertheless, prevention i s still best. But remember—tanning lotions are not necessarily sunscreens: many only dye your skin. Some are only iodine in baby oil and these dye your skin, they do not tan. Furthermore, baby oil seems to increase sunburning instead of preventing it.

At the b e a c h, a big broad-brimmed hat and a tightly woven robe and mosquito netting is one answer—if you can take it all. The other answer is a protective sunscreen. These are of several different kinds: heavy pancake makeup, zinc oxide ointment—that u g l y messy white stuff—titanium dioxide a n d red veterinary petrolatum. The latest is a group of chemicals—the benzophenones, and, not quite so effective, para-aminobenzoic acid. These work either by blocking the UV rays or by absorbing them.

You can even take you protection inside instead of outside. There is another Pill now—a suntan pill, but there seems no general agreement among doctors on the use of it.

With proper care, your skin *can* last a lifetime—and never look old.

For further reading

MAN MEDICINE AND ENVIRONMENT. *Rene Dubos. Frederick A. Praeger Publishers. 1968.*

The underground movie thing

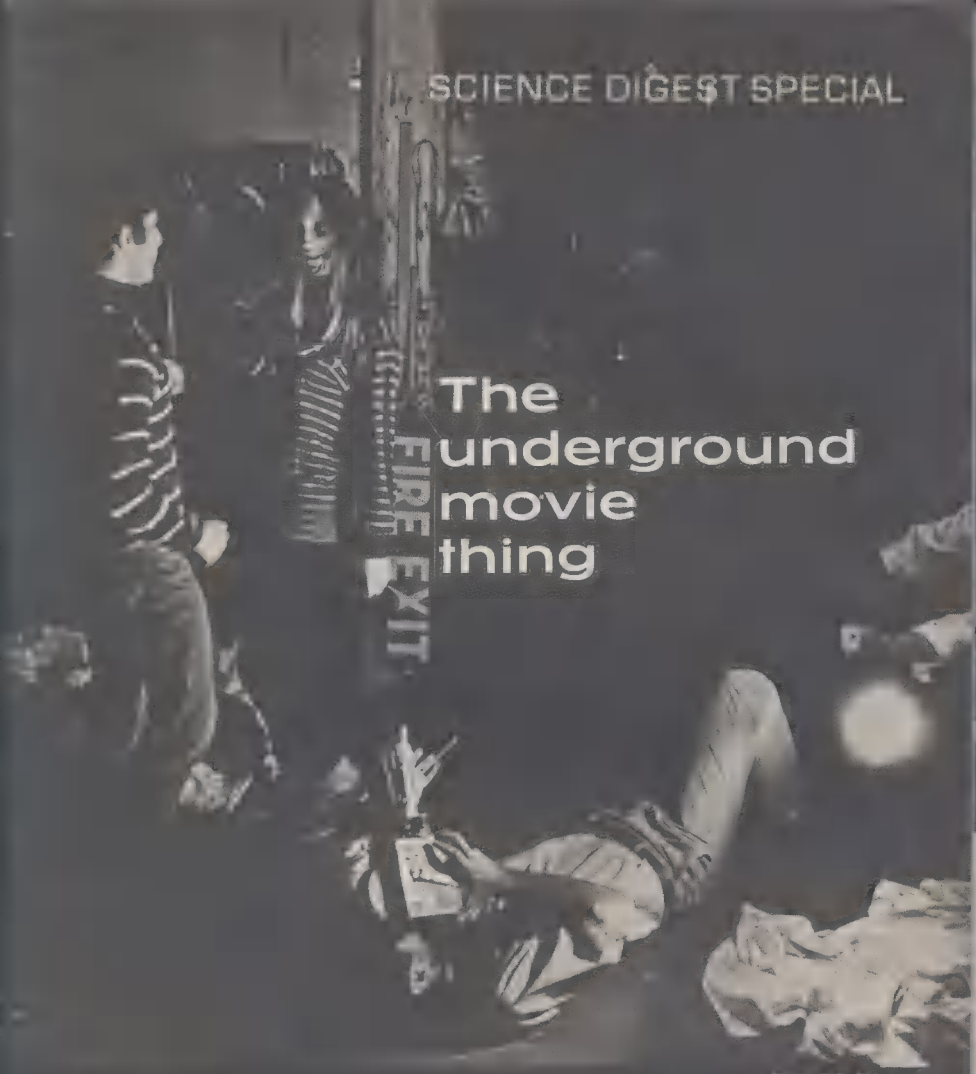


Photo: Bob Combs

Young people used to write poetry or novels but now they want to express themselves in film instead of print. Some of the movies they're making with handheld cameras and amateur actors would surprise you.

by Barbara Ford

SUDDENLY AMERICA is crawling with independent movie producers. Three-year-old children are making films. Still photographers have exchanged their 35 mm reflexes for a "Bolex 16" and are shooting their first features. Underprivileged youngsters in the slums are out in the streets with low cost, handheld,

Photo by Ken Morais

Scene from a yet-to-be-released Jack Smith film incorporates sex and sadism motifs for which the filmmaker is noted. His *Flaming Creatures* (1962-63) is the only underground film banned in New York State, but some critics praise his work highly. Smith has acted in underground films, too.

whirring 8 mm Kodaks to record the life around them. Educators are dramatizing their material by involving their classes in filmmaking. Technicians are putting their skills to artistic use by making "computer films." But the biggest group of new producers is in the colleges, where an estimated 80,000 students are enrolled in some 3,000 film courses at 200 schools.

Last December, I spent a bleak, gray morning in a snow-blanketed Brooklyn junkyard watching two New York University graduate students shooting a modern saga tentatively entitled *Memories of My Father's Junkyard*. Mark Sadan, the writer-director, scouted locations while Fred Aranow, cameraman, focused his fancy (for this type of movie-making) Arriflex on carefully selected piles of rubbish. A grinning workman wandered by. "What kinda movies is this?" he asked. I told him. "Hell," he said, "I though it wuz big

time. *Boys*!" he hollered, "You'll never make Broadway with a scrapyard movie."

Next day I saw rushes of the film in NYU's new projection room. Film students and teachers sat in awed silence as they watched technically beautiful photography of junk being lifted, dropped, poured and pushed. In another sequence, a small boy—hero of the film—played with metal scraps. Then background shots of the day before appeared. Piles of trash that had looked like nothing at all formed intricate, abstract patterns for title backgrounds.

But the workman was right about *Memories*. You'll never see it on Broadway or at your local movie theater. Independent films—also called "underground," "avant garde" and "experimental"—are usually destined for the obscurity of a college film festival or a museum showing. If well received, or if their director is particularly renowned, they may have a brief run in a commercial theater in a big city. But it is hard to see such films even in New York, where even top independents have only one or two outlets for their creations. When I was looking for an independent film showing in the city, only one—Andy Warhol's *Flesh*—was being shown at a public theater, which happened to be owned by Warhol. A few others were being shown at the Museum of Modern Art and the Jewish Museum.

Independent films being turned out by the new movie makers vary as much as their creators. Some are technically expert; in others the camera wobbles, the picture is out of focus, the film under- or over-exposed. A few are shocking or obscene; some as tame as a family picnic. Some run a few minutes; others up to eight hours. One, Robert Breer's *A Miracle*, is 14 seconds long. Almost all independent films have a few things in common: they are intensely personal expressions of the movie maker's views; they're almost always shot with the cheaper 8 mm or 16 mm film (most commercial movies are made with 35 mm); and they *usually* lack both plot and dialogue. Absence of dialogue is often a reflection of economy. Synchronized sound is simply too costly. They may use a taped sound accompaniment, sometimes effectively.

Independent films typed

It's hard to categorize independent films since they are so individual, but there are some broad types of production.

Juveniles. Last year, Cristina Rodriguez, age three, made her own movie with an 8 mm camera at her home in Vermont. Clutching the small instrument, she ran around photographing objects at her own eye level: rocks, headlights, her brother's eyeballs. Later her father, Zane Rodriguez, who teaches a film course at Fordham University in the Bronx, N.Y., filmed Cristina's reactions to her own film, spliced the two films together and showed it at the Young Filmmakers Conference at Fordham last fall. The 1,110 youngsters at the conference, none of them over 18, applauded the film boisterously.

Cristina is not the only tot filmmaker. At the Cellar Door Cinema and the Yellow Ball Workshop, both in Lexington, Mass., children as young as five are turning out animated cartoons. They make the

Rockefeller Foundation

Young people from the New York area shot a film on a ghetto street recently under a Mobilization for Youth program funded by the Rockefeller Foundation. Called *Where We Live*, the film documents the daily lives of two families, one in a tenement, the other in a housing development in a crowded city area.

figures themselves from clay or paper, construct the sets and dream up the story line. Animation is achieved by photographing the movable figures a few frames at a time. Mrs. Marjory Lenk, who directs the Cellar Door Cinema, says today's children seem to take to films as naturally as to crayons. "I think it must be due partly to television," she says. "They really love working with film. They come after their regular school and I have more applicants than I can take."

The pleasant little cartoons turned out by Lexington children are the antithesis of the abrasive products turned out by Rivington Street Film Club on Manhattan's Lower East Side. Here underprivileged youngsters in their teens, many of them high school drop-outs, focus on the life around them in the crowded streets and narrow hallways. I watched one movie, *The Thief*, by Raymond Esquilin, 19, which showed a teen-aged boy coming in through a kitchen window, threatening the woman tenant with a knife and stealing her purse. Later, he saw the tenant's face everywhere he went —at the movies, in the corner restaurant, under an umbrella in the park. He returns the money.

"*Our* films are strong on action and plot—the interactions between people," says Jaime Barrios, the young Chilean who directs the project. "They have a go-back-to-the-streets immediacy." Barrios has never seen a mother or father or any older relative portrayed in his group's 40 films: these youngsters stick to their own age group.

Collegians. The 80,000 students enrolled in film classes are not *all* making films; some are simply studying the art. At NYU, Columbia University, the University of Southern California, UCLA, Northwestern, Notre Dame, Boston University and a few other schools, however, collegians do turn out their own movies. Observers of the college film scene say that the subject is often "non-communication." The students like to set their movies in empty houses, graveyards, vacant lots—or junkyards. Often, the people they portray are society's drop-outs. Peter Jensen, 24, of UCLA, made the well-received movie, *Eating Cake*, about an

old man celebrating his birthday alone. A young Boston University student came up with a film about a hermit. I saw an NYU film in which a group of shabby old men beat up a young couple in an automobile graveyard. Like most college films, this effort was virtually plotless; independent filmmakers regard plot as "old fashioned." Some of these student films are beautifully photographed, however—the result of the fine technical training provided at a few top schools, including NYU, UCLA and USC.

"Our students will never advance to the second year without technique," says Beda Batka, associate director of NYU's prestigious graduate film school, which last year accepted eight new students out of 350 applicants. "In the second year we have no discussion on the basics of technique; we concentrate on form and content. Some of the students leave when they realize what hard work it is."

Shockers. As a result of the publicizing of a few independent movies made with a no-holds-barred approach, many people expect all independents films to be amoral shockers. Actually, few are, although independent filmmakers are free to photograph whatever they please. In the 30 or so independent films I saw recently, only three contained nude scenes and two of these were of pregnant women, biologically complete with pubic hair and distended stomachs. As Sheldon Renan points out in *An Introduction to the Underground Film*, "There is more nudity in underground films than there is in commercial films, but there is less sex." There are some genuine shockers, though, and a few have been banned. One of these, Jack Smith's *Flaming Creatures*, concentrates on the male sex organ seen in peculiar surroundings. Kenneth Anger's much-publicized *Scorpio Rising* treats male homosexuality in some explicit scenes. One of the best known independents, Stan Brakhage, has some shockers among his prolific output. One, *Flesh of Morning*, is about masturbation; another, *Films by Stan Brakhage*, shows Brakhage and his wife making love.

See it more than once

Innovators. A number of independent filmmakers are expert technicians who have expanded film art, sometimes to a point almost beyond comprehension. Brakhage's name pops up in this category, too. In an effort to represent actual vision, both with the eyes open and closed, he uses distorting lenses, scratches the film, grows mold on it, paints it, bleaches it, even spits on it. His major work, *Dog Star Man*, is compared to *Finnegan's Wake* in its complexity. Basically, there's only one action in the 78-minute opus—a woodsman climbs a hill and chops down a tree—but superimpositions, collages and montages call for repeated viewings to sort out the images. Repeated viewings of their work are urged by most independent filmmakers; with Brakhage, the extra effort is well worth the time. He has made one film, *Mothlight*, without a camera by pasting a line of moth wings and bits of plants between strips of mylar tape and running it through an optical printer. The result, he says, is "what a moth might see from birth to death if black were white." Treated with Brakhage's ex-

pertise, this moth's-eye view is surprisingly effective.

Another innovator is Stan VanDerBeek, inventor of the Movie-Drome. The Movie-Drome, which stands on the VanDerBeek property at Stoney Point, N.Y., is a small, dome-like metal building in which 30 people can lie with their heads towards a central projection control while a multiple projector film called a "movie-mural" is shown above, around and on them. VanDerBeek's plans are ambitious. He wants to develop a new "visual language" that can be used to communicate between all the cultures of the world via movie-dromes like his, and satellite television stations. "I am trying to evolve a 'litera-graphic' image, an international sign language of fantasy and satire," he says. "There is a special literature through filmic pantomine—that is, non-verbal comedy satire—a 'comic-ominous' image that pertains to our time and interests."

Minimals. At the opposite end of the pole from the innovators are the members of the minimal school of independent films, headed by the ubiquitous Andy Warhol. Warhol, who once said, "I like long, boring things," has released an eight-hour bore showing nothing but the exterior of the Empire State Building (*Empire*) and a six-hour movie of a man sleeping (*Sleep*). Along the same lines are Tom Anderson's study of a melting ice cream sundae; Tony Conrad's *The Flicker*, in which bright blank frames are interspersed with solid black frames; the artist Tanya's movie of feet; and Michael Snow's prizewinning *Wavelength*, a 45-minute zoom shot of a loft interrupted by just four human actions. In one minimal movie I read about (minimal movies are more read about than seen), the filmmaker took nine-hours to portray his father's lawn. The high point occurs when the father comes out of the house and mows the lawn.

The maximum minimal is undoubtedly Nam June Paik's *Zen for Film*, which has no images at all; just clear film and the author-director standing in front of the projector light, meditating. Nam June Paik declares that he is, for that moment, "a living movie."

There's a lot of ego in the independents.

There usually is a rationale behind minimal movies, however hard it may be to find. Michael Snow, the serious young artist-producer who made *Wavelength*, compares it to Cezanne's attempts to show the balance between color and form. "I was trying to do something very pure about the kinds of realities that are involved," he says. The film took him only a few weeks to shoot, but a year to edit—the usual proportions in a minimal movie.

Computer Films. The most unusual independent films turned out today are the product of an unlikely collaboration between the filmmaker and the computer. I watched a number of these computer films at the Museum of Modern Art and they're different from anything I've ever seen before. Bright colored lines on a black screen sway like a fence being blown by the wind. The lines are succeeded by dots, then by rectangu-

Rockefeller Foundation

Filmmakers in Mobilization for Youth program gather around editing table to cut footage shot for *Where We Live*. Rockefeller Foundation program puts ghetto youngsters behind a movie camera to record their own lives.

Inside Stan VanDerBeek's Movie-Drome (left) at Stoney Point, N.Y., 30 people can lie on the floor with their heads towards the center while a multiple projector film (below) is shown on and around them. So far the Movie-Drome is the only one of its kind in existence, but VanDerBeek, who's shown here, envisions them all over the world to help various cultures communicate with each other. An innovator in the underground film movement, VanDerBeek has won a number of film awards.

lar solids. Everything is in constant motion; lines and dots join together in pattens, fly apart, move back in the screen, come forward. "I find when I have a morning like this and I look at these computer films, it's very soothing," said Mrs. Lillian Gerard of the Museum, who arranged the showing. I didn't find the agitated movement really soothing, but I can see such films as a pleasant accompaniment to conversation or dinner.

John Whitney, a Los Angeles resident who is experimenting with computer films under an IBM grant, thinks that we'll get the same emotional sensations from computer images as we now do from music, once we have developed standards for the images similar to those for music. Whitney makes his computer films by programming a computer to reproduce a sequence of forms of his choice. The machine works at tremendous speeds, drawing 10,000 to 1,000,000 dots, lines or characters per second—much faster, of course, than any human draftsman could do the work. The forms appear on a display scope that looks much like a television screen and are transferred to film by a movie camera plugged into the computer. The computer

tells the camera when to open its shutter and when to close it.

Why are people of so many different ages and tastes making films today? Some of the reasons are obvious. In the last few years, movie cameras and film have come within the price range of almost everyone. You can make a good, well-edited 8 mm film for $100; a 16 mm film of professional quality for less than $1,000. Enterprising young filmmakers have made movies for less with scraps of films and borrowed cameras. One entrant in Kodak's teenage movie awards contest called his film *8½* because he made it for $8.50. Ron Rice, whose three films

are highly regarded in some circles, made his first, *The Flower Thief* (1960), on practically no funds at all by salvaging machine gun film from World War II fighter planes. Today a filmmaker like Rice might not have to resort to that. Cooperatives, government grants and film-conscious colleges are making it possible for talented but impecunious filmmakers to make the kind of movies they want. But rationale for the craze goes deeper than economics.

According to Marshall McLuhan, the Canadian professor whose last name has already become an "ism," we're changing from a linear, book-oriented society to a visual, "non-verbal" society oriented to television, movies and other technological media.

"Film satisfies the person who is part of the machine age," points out Dr. Richard Steele of Boston University's film department.

"This is the first TV generation," says Professor Colin Young of the Department of Cinema at UCLA, of the present crop of young people. "When they cried as babies, they were put in front of a TV set instead of having something put in their mouths. They've learned a cinematic language, a language of continuity which is now instinctual. Film is not something they have to sit down and think about. They do it."

Pace Magazine recently commented that by the time boys and girls have graduated from high school, they have seen 500 feature films and spent 15,000 hours in front of the television set.

"Kids grow up in a world of television, stereo and color movies and we give them the printed word. We're behind the times," says Zane Rodriguez, who teaches film at Fordham. "The first step ought to be to make movies." For film buffs like Rodriguez, film has definitely superceded print. "Writing is a dead art," he claims. "It's becoming a tactile, non-aural world."

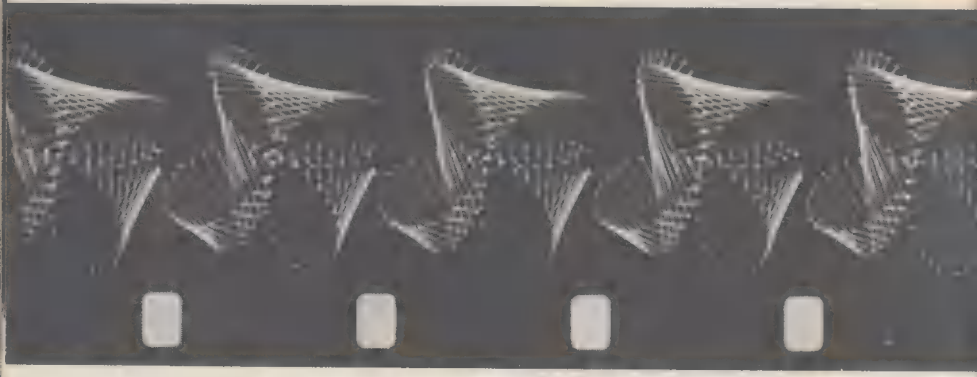
Says Brooklyn filmmaker Randolph Herr, 20, "Movie making is just a scientific improvement over the novel. It's the best way to express things nowadays."

The conventional theater no longer fills the place of film, either, according to these entrepreneurs. "Theater doesn't exist for the young," says Richard Steele. "They know nothing about it."

'Young distrust words'

"They are quite distrustful of words," adds Robert Gardner of the Carpenter Center for the Visual Arts at Harvard University. "They see so much evidence of the hypocrisy of words from every side that they have turned to film to express themselves." There seems to be, with the fraternity, a belief that "pictures don't lie." At the Rivington Street Film Club, Jaime Barrios declares: "Our kids aren't verbal at all. Once a film critic asked one of our filmmakers, 'What's the meaning of that scene where the girl is drunk?' The boy said, 'What do you mean? There's no meaning. She's just drunk.' "

Film people, like everyone else, exaggerate for effect. The number of bad independent films indicates that not all young people imbibe the principles of film like mothers' milk. Most of those who have achieved recognition do sit down and think about their movies beforehand. Without planning, results are usually



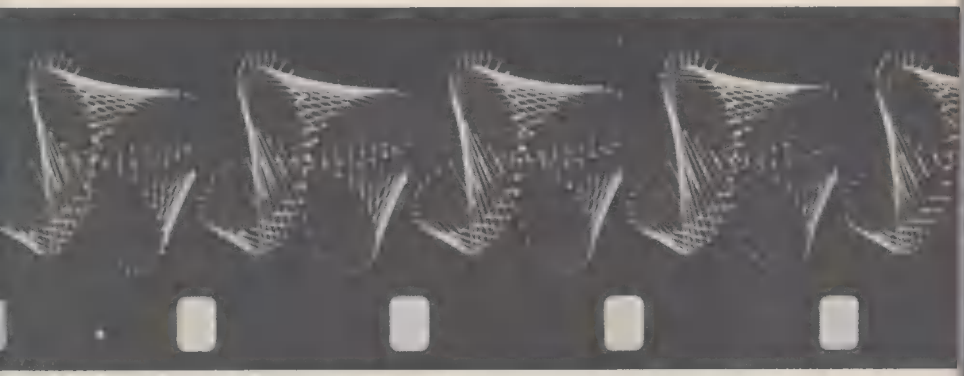
Film strip (above) is from John Whitney's computer film, *Permutations*, in which lines and dots form moving patterns on the screen. Whitney makes the films with an IBM 360 Model 75 which is programmed to reproduce forms on a display scope (left) that looks like a television screen. Movie camera plugged into computer photographs the images automatically. To get a color movie, Whitney rephotographs black and white film through color filters. The Los Angeles resident has an IBM research grant for his pioneering work with computer films.

poor. Zane Rodriguez, who recently viewed seven hours of student films, found most of them "horrible."

"It was their lack of structure, mostly," he says, counseling better planning and editing. Nor is the printed word on its way out quite yet. If students are fighting to get into the comparatively few graduate film schools, they're also fighting to get in the better graduate schools of English. It's significant that the views of those who turn thumbs down on print are spread, in great part, by print.

If you're curious to see good independent movies for yourself, the best way is to rent them. The Film-Makers Cooperative, 175 Lexington Avenue, New York, N.Y. 10016, rents between 600 and 700 films to individuals and organizations at low rates. The Cinema 16 Film Library, Inc., 80 University Place, New York, N.Y. 10003, rents about 200 films, including some by acknowledged masters of the independent film. Their rentals range from $7.50 for a three-minute short to $75 for a two-hour feature. Both organizations have catalogs.

If you can't screen your own mov-



ies, look for college film festivals that show new movies by students and other independents. Best known is the Annual National Student Film Festival held at Lincoln Center in New York City; last year, 37 entries were shown. A few outlets are currently showing independent films in Manhattan on weekend evenings: the U-P Cooperative, 814 Broadway; the Millenium Film Workshop, 53 Pitt Street or 2 East 2nd Street, and Maurice Amar's Movie Loft, 61 E. 11th Street, which shows Maurice Amar and other films. In Chicago, you can join the Magic Lantern Society of the Society of Typographic Arts, which shows independent films. Write the Society at 400 N. Michigan Avenue, Chicago, Ill. 60611. Cinema Kenmore Square in Boston shows independent films on Friday and Saturday nights.

In the future, you may not have to depend on renting films or an occasional film festival to view the latest independent releases. You'll have your own inexpensive movie theater right in your home. Michel Whitney, who, like his father, John, makes computer films, suggests that someday independent productions may be played on the home TV set via a playback system. Technicians say such a system is feasible. If it becomes a reality, an independent movie maker could put out his work like a pop record and possibly be as successful as some of the pop music makers. According to Marshall McLuhan, film is now in its "manuscript" phase; he expects it to soon go into its "printed book" stage with small, inexpensive projectors that play 8 mm sound cartridges on the same machine that does the projecting.

Visualize it: during cocktails, you'll show a computer movie as a pleasant background to conversation. For dinner, nothing too strong—perhaps one of Stan Brakhage's gentle 8 mm *Songs*. After dinner, the sky's the limit: Jack Smith, your own epic two-hour portrayal of your left eyebrow, an independent newsreel, *Wavelength*. It'll be a McLuhan world—with, we hope, a few books.

For further reading

AN INTRODUCTION TO THE UNDERGROUND FILM, *Sheldon Renan, E. P. Dutton & Co., Inc., 1967.*

A SCIENCE MYSTERY

Who put the handprints on PRAYER ROCK?

A chunk of granite with handprints and crude drawings was found in South Dakota nearly a century ago, but not until recently did it receive much attention. Experts now wonder if it could be a relic from an unknown past civilization.

by **Reed C. Hildreth**

THE OLD-TIMERS of Marshall County, South Dakota, are amazed at all the fuss being made over a grayish-brown chunk of granite discovered amid the Coteau des Prairies Hills on top of a butte called Windy Mound. Men like Newton Jones, an attorney, can recall the rock's existence from their boyhoods, as far back as 60 years ago. Even then, the 1,870-pound rock was interesting, but nobody thought (or did) much about its strange carvings.

Prayer Rock, as it is now known, has been positively identified as an ancient Indian artifact; its possible historic importance was first recognized about five years ago.

Perhaps the most significant things about Prayer Rock are the pictographic symbols chiseled into its smooth face. At each side are handprints. The thumbs are on the outside, suggesting that hands might have rested on the rock with palms turned upward in a gesture of supplication.

At the left edge is a sun disk with its rays directed across the top to the right. The disk, with its radiating lines, bears a strong resemblance to the foot of a large bird. On either side of the disk are two smaller figures that are difficult to read.

This disk appears to act much like a sun dial. It makes the sun's shadow at sunset on the winter and summer solstices, the equinoxes and three other dates that have no meaning to researchers.

To the left of the sun dial is a cross with two crossbars and vertical bar with forked bottom. Here lies the first controversy over Prayer Rock. The figure is quite similar to a Chinese number nine.

Although Prayer Rock's significance is still being debated, acknowledgment of its authenticity was fast in coming from two sources. A. Z. Nelson, a student of Indian rock art from Grand Forks, N. D., called Prayer Rock aboriginal Chinese and at least 4,500 years old.

No doubt the oriental looking figure had something to do with Nelson's decision, but no other authority has been willing to climb out on the same limb.

The Nelson theory hangs on one thread of possibility. Archaeologists have found traces of mound civilizations forming a pattern across the continent from the west coast. Most notable are ruins of an almost modern city in Alaska. Its artifacts show traces of an Asiatic culture. The nearby Bering Straits would be a logical route for migrating Asiatic tribes.

Henry B. Collins, then acting director of the Smithsonian Institution, was less specific in his analysis. He called the rock a prehistoric Indian petroglyph (rock picture). Collins did not choose to speculate on an exact age or the significance of the double barred cross.

Current speculation is that Prayer Rock and the Windy Mound area may pinpoint the center of a very ancient civilization. The mound itself would be the logical center of any theocratic (religiously oriented) government.

Other mound dwelling societies chose with exactness the highest ground for their religious shrines. Windy Mound fulfills this requirement, and Prayer Rock implies the existence of a religious center.

Who were these mound dwellers? Chinese or Indian? Only time will tell, but it is safe to say that residents in southeastern North Dakota and northeastern South Dakota may be sitting on top of a very old and surprisingly advanced civilization. Exploration of other mound dwelling civilizations reveal that they did have a written language, did build their cities on a complex pattern, did understand basic mathematics and a form of geometry. They kept records and maintained census figures.

Tepee rings and ruins of what appear to be mound dwellings are known to have been unearthed at Windy Mound by an expedition in 1926. Further digging would no doubt provide additional clues.

The proud Sioux roamed these hills long before the white man. Yet there is a time gap between them and anything close to 4,500 years ago, and their folklore does not fully explain the rock's symbols.

Ceremonial dance performed by this Dakota youth is reminiscent of ancient Indian culture in Windy Mound area. Was it some wandering holy man dressed something like this who carved Prayer Rock? The answer is still up for grabs.

They do know that Windy Mound has long been a Wakan, or sacred place. The William D. Neill papers at Macalester College in St. Paul contain the manuscript of a Sioux translated into French at Paris in 1719. It describes the land of the Thunderbird 30 miles northwest of Big Stone Lake on the Minnesota-South Dakota border. An 18th century explorer's map puts the home of the Thunderbird in the same region which is one and a half miles directly northeast of Windy Mound.

This Thunderbird legend is one that is found in varying forms in Indian cultures throughout North America. Some speculate that it had its origin at Windy Mound. There is an ancient Sioux legend telling of a Sioux chieftain coming to the rock because it was the dwelling place of this Thunderbird. In Sioux mythology the Thunderbird symbolized the power of their god on earth.

The old chief knelt before the rock, praying from dawn until dusk, pressing his hands against the rock with the palms turned upward. It was a gesture of giving and also one of receiving.

Possibly he prayed for rain, or good fortune in battle, or even for an end to disease within his tribe. At sunset, completely exhausted, he arose; but his handprints remained imbedded on the rock. Later chieftains came to this same rock to pray, each placing his hands on the prints left by this leader of so long ago.

What will happen to Prayer Rock? Residents of Britton, S. D., 125 miles west of Minneapolis-St. Paul, suddenly find their locality abounds in Indian and frontier history. A museum has been opened to house these artifacts and Prayer Rock is a main attraction.

And one thing is certain. Prayer Rock has escaped charges of fake so often leveled at similar discoveries, but controversy will most assuredly swirl around its significance.

Chinese? Indian? One time center of the Continent? Home of the Thunderbird? You can pay your money and take your choice.

Lost continent—maybe

DID A CONTINENT once sink below the surface of the Caribbean Sea? *Columbia University* scientists working from a *Duke University* ship have brought up continental-type rocks from the Aves Ridge, an underwater formation that runs from Venezuela to the Virgin Islands. The rocks are a light colored granite like that thought to be confined to continents, and nothing like them has ever been found before on the floor of the open ocean. A fundamental geologic concept is that dark-colored basalt composes the earth's crust beneath the sea. One interpretation is that the rocks are being formed to build up a new continent.

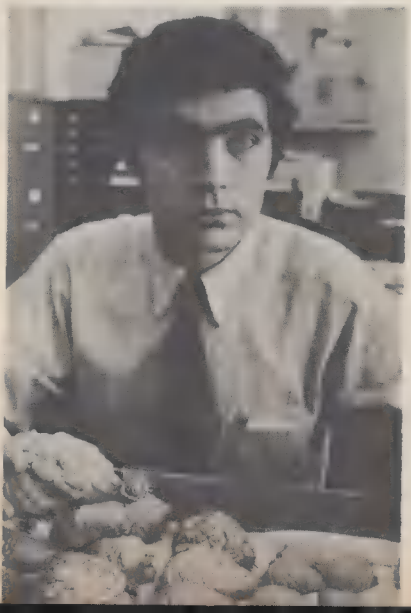
Monkey business differs

The behavior of one kind of monkey differs distinctly from that of other kinds, a study by *University of South Dakota* and *University of Oregon* researchers indicates. Rhesus and cebus monkeys spend much of their time manipulating objects; stump-tailed monkeys specialize in social grooming, and woolly monkeys like to vocalize more than the other species. Lemurs, who were also tested, seem to spend most of their time just looking at things. Judging from these results, it may be unwise to apply conclusions about behavior in one species to another species even of the same genus.

Now we're worth $3.50

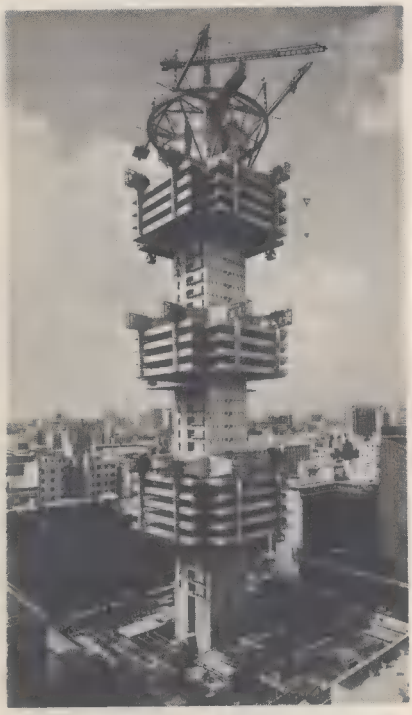
The price of everything is going up, including that of the chemicals in the human body. In the depression era, the chemicals in the average body were worth only 98 cents; now they've risen to $3.50, says Donald T. Forman of *Northwestern University Medical School*. In percentage terms, the adult body is composed of: 65 percent oxygen, 18 percent carbon, 10 percent hydrogen, 3 percent nitrogen, 1½ percent calcium, 1 percent phosphorus. There are also traces of gold, silver and other elements that add up to 1½ percent.

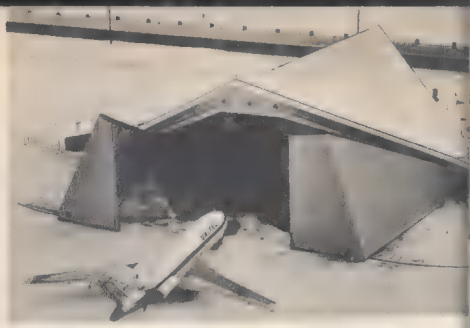
Secrets of the brain are being discovered by Leonard B. Radinsky, assistant professor of anatomy at the University of Chicago. He is making latex casts of the insides of braincases of fossil and contemporary mammals. Here he holds a cast of an ice-age cave bear.



NEW FOR INDUSTRY

A new 524-foot sky-scraper in Johannesburg, South Africa will appear to float over the skyline of the city when it's completed. Each of the 34 floors is suspended from a central concrete core and will have no visible support or columns. This architectural concept makes for considerable speed in construction.





Jet-shaped hangar (above), which looks like it might suddenly take off into flight itself, has been built and is operational at United Air Lines' terminal at Wold-Chamberlain Field in Minneapolis. The configuration of the building conforms to the shape of a Boeing 727 and a McDonnel-Douglas DC-8. It will be used in overnight aircraft maintenance. The hangar is unique not only because of its shape but also because of the economy of its construction: it takes up only ⅓ the space of a conventional hangar. Designed by Miller-Dunwiddie, Inc., of Minneapolis, Minnesota.

"Jet channeler" (right) can cut through solid granite almost as easily as a knife cuts through butter. Until recently, the only way to hew multi-ton blocks of granite from the walls of a quarry was by blasting with dynamite. But the jet channeler solves the problem by cutting blocks with a 4,000-degree F. flame. Where the flame hits the granite, a ⅛-inch layer of the rock heats up and expands, then flakes off. To create the ultra hot flame, fuel oil and oxygen are fed to the nozzle through separate pipes. Shown here at Rock of Ages Granite Quarry, Barre, Vermont.

You'll have better telephone service, even during storms and floods, because of a simple fact—"water and oil don't mix." Bell Telephone, Murray Hill, N.J., has come up with an underground telephone cable (right) that is nearly impervious to water. They did it by encasing the wires within the cable with a congealed mixture of petroleum jelly and polyethylene plastic. The plastic/jelly mixture fills about 47 percent of the cable—a space usually filled with air. If the casing on ordinary cables breaks, water can short-circuit the wires. This new cable is being field-tested in Iowa, North Carolina, Mississippi and Alabama. The Southern locations were chosen because of much more severe weather conditions than any other part of the United States.

This girl below is surrounded by electrical components that are now obsolete because of the tiny device she holds in her right hand. Texas Instruments, Inc., Dallas, has developed the electronic circuit called an LSI (large scale integration) array that does all the work of the clutter of components. This single wafer-like circuit she holds, about the size of a half dollar, replaces 700 vacuum tubes, 1,000-4,000 transistors and 70 integrated circuits. It will allow engineers to use computers to design top circuitry.

Rescuing crews from damaged submarines may be done more easily because of a deep submergence rescue vehicle (DSRV) now being developed by the Navy. This prototype deep submersible (right) is now under construction at Lockheed Missiles and Space Co., Sunnyvale, Calif. Shown here as an artist's concept, the vehicle is one of six that will be able to rescue up to 24 crew members at a time. It will be transported "piggyback" aboard a "mother" nuclear submarine. In this view, the DSRV is shown mating to the restraining guide wires and the "piggyback" berth aboard the mother nuclear-powered submarine.

Last rites—
do they bring fear or reassurance?

by Arthur J. Snider

WHAT is the psychological effect of last rites on the conscious, seriously ill patient? A group of doctors at Harvard Medical School investigated the effect of the sacrament on 30 patients hospitalized with a tentative diagnosis of heart disease.

For most patients, last rites are anxiety-provoking ("The end," "This is it," "You've had it"), but they also have a religious significance which appears to be positive or reassuring, the doctors found.

"The positive meaning attached to last rites appears to entail gaining a more desirable state intimately linked with God, guilt, grace and the hereafter," reported Dr. N. H. Cassem in *Postgraduate Medicine*.

"Thus what is anxiety-provoking under one aspect seems to be anxiety-reducing under another."

The physician could be of help to the priest in determining which patients are more likely to be troubled, Dr. Cassem added. The manner in which the priest administers the last rites may be particularly important in reducing anxiety in these patients.

It was found that patients given an explanation about the routine nature of the procedure seemed to respond more positively.

The study took place in a large metropolitan general hospital where a priest is routinely called to anoint Roman Catholic patients. Thirty were interviewed—8 women and 22 men with an average age of 58.3 years.

Twenty-six of the 30 responded favorably to last rites. Thirteen admitted to experiencing anxieties or

expressed some criticism of the procedure but remained firm in their endorsement of it. Four patients refused the last rites.

Those who reacted positively said the most reassuring elements were the priest's presentation, his ease or calmness of manner and emphasis on relationship of the sacrament to prayers for healing or recovery.

Among those suggestions favoring some change was one that the priest should come later, preferably when the patient is not in the emergency ward, and another suggestion that the physician should inform the patient that the priest would be in to see him as a routine hospital policy.

Spine deformity no handicap

A long-term followup of middle-aged patients who develop abnormal curvature of the spine (scoliosis) as children shows that most are married and are leading active and productive lives.

One man with the severe back deformity wrestled in the 1948 Olympics and now is coaching at a large university.

However, curvature does continue to increase throughout life if a spinal fusion is not done in adolescence, says Dr. Dennis K. Collis of the University of Iowa hospital department of orthopedic surgery. Curvature increases an average of 15 degrees after the end of the trunk growth period.

Ninety percent of the patients contacted were married and were parents of an average of 2.7 children, Dr. Collis reported to the American Academy of Orthopedic Surgeons. Occupations ranged from office work to heavy labor, and hobbies, from sewing to horseback riding. Only 16 percent said they restricted their activities because of scoliosis. None had surgery. Their treatment consisted of exercises and braces.

"The patients' social-psychological reaction to their back deformity was difficult to assess," Dr. Collis said. "Many indicated that while they felt their deformity embarrassing when teenagers, they were rarely conscious of it after marriage."

Back pain was no more common than in the general population. A death rate of 6.9 percent in this group of patients compared favorably with 5.4 percent among a similar age group in the life insured population.

Relief from gout

With several drugs now available to combat the disorder, dietary treatment of gout now has been relegated to a secondary role, says the National Institute of Arthritis and Metabolic Diseases.

Long believed to be the result of "high living," gout has been treated for centuries by restricting certain foods in the diet. But today patients can be maintained with comfort because of the progress that medical science has made during the recent years in understanding and controlling the painful disorder.

Gout, a form of arthritis, affects some half-million Americans. It results from an inherited defect in body chemistry that disrupts the metabolism of uric acid. The salt crystals of uric acid accumulate in certain tissues and joints, causing recur-

rent and painful attacks of gouty arthritis.

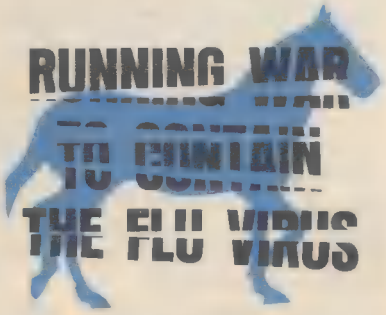
New drugs act to rid the body of excess uric acid and also prevent its accumulation in the body. The newest drug to be tried is allopurinol, which attacks the body's production of uric acid at its source and prevents over-production.

Progress also is being made in discovery of the basic causes of gout. A specific enzyme associated with the over-production of uric acid has been found in a number of gouty patients.

Flu may hide in animals

The theory that human influenza epidemics may originate in animals is given further support by the discovery that the Hong Kong flu virus is closely related to an influenza virus of horses.

In an experiment, Dr. Julius A. Kasel of the National Institute of Allergy and Infectious Diseases, and Dr. Robert B. Couch of Baylor University, infected 23 adult male volunteers with a horse influenza virus. The majority produced protective antibodies that reacted not only to the horse virus but also to the new Hong Kong flu virus.



As a reverse test, blood from five Hong Kong flu patients contained antibodies against the horse agent. These cross-reactions suggest to the investigators that the two viruses share one or more components and have a close relationship.

Dr. Kasel points out in the *Journal of Immunology* that the origin of human flu epidemics has long puzzled scientists. Outbreaks recur periodically, causing much illness for a year or two, then phase out as the population builds up immunity. Then in a few years a new strain of influenza virus may appear which is sufficiently different from the old to overcome immune defenses. This leads some scientists to believe that between epidemics the virus may reside and multiply in animals, changing its genetic characteristics enough to become a new-type virus.

Push-button pain reliever

A push-button electronic pain-reliever is bringing comfort to heart victims who cannot be helped by nitroglycerin or surgery. The implanted device is being tested on 90 patients who suffer from angina pectoris, the distressingly painful condition caused by insufficient flow of oxygenated blood to the heart muscle in individuals who may or may not have had a heart attack. Many patients develop a vise-like grip in the chest after walking a short distance or in other slight exertion. Even eating a meal, which requires diverting circulation to the digestive tract, can trigger a spasm of pain in a blood deficient heart.

For decades, doctors have instructed patients to slip a tiny white pill, nitroglycerin, under the tongue

when an angina pain occurs or is anticipated. Nitroglycerin expands the clogged coronary arteries to permit an increased flow of oxygenated blood to the heart muscles. But in some patients, the diseased arteries have limited ability to dilate. Nitroglycerin brings no relief.

It occurred to some physicians that many of these chronically disabled persons might be helped by approaching the problem from another direction—slowing down the heart action so less oxygen would be required. The first instrument designed for that purpose was introduced by the National Institutes of Health in January 1968.

Pushing a button stimulates a pair of sensors—the carotid sinus nerves on either side of the neck—to send a signal to the brain to reduce the body's blood pressure and heart rate, thus lowering the work load and oxygen requirement of the heart.

An electronic receiver, about the size of a pocket watch, is implanted under the patient's skin at chest level. Two platinum wires, also implanted, lead to the carotid sinus sensors. Resting atop the receiver, on the outside of the skin, is a circular antenna that receives radio signals from the patient's push-button box, carried in the pocket or worn on the belt.

The first patient to be tested by NIH was a 54-year-old artist who experienced an average of eight episodes of anginal pain every day and required narcotics for relief. Other clinical trials have since been reported in the medical literature. At Indiana University Medical School, a 40-year-old telephone lineman who was totally disabled by pain and could not walk for more than a minute at a time, was returned to his job which requires walking several flights of stairs each day. In New Orleans, a 42-year-old housewife who lived a bed-to-chair existence, now does her own housework again.

Pregnancy weight-gain

How much should a woman be allowed to gain during pregnancy? Most obstetricians have favored a range of 16 to 20 pounds. But Howard Jacobson at the University of California believes 24 pounds is not too great a gain under normal circumstances.

He notes that underweight mothers often give birth to underweight babies and there is a link between light babies and infant mortality. The U.S. infant mortality rate is 13th among nations.

Quick-fitted artificial limbs

Fitting an artificial hand or lower arm immediately after amputation —a practice now widely tried in below-knee amputees—is being used with good results at Jackson Memo-

rial Hospital, Miami. Dr. Augusto Sarmiento says that applying the temporary prosthesis has helped patients by reducing pain, facilitating a more rapid use of an appliance and promoting better psychological adjustment to the disability.

Patients are instructed to operate grasping hooks as early as the first day after operation. The first, a 32-year-old man bitten on the right hand by a rattlesnake, was able to operate a hook control appliance well enough to feed and dress himself 17 hours after the hand was removed. He was fitted with a permanent prosthesis 60 days after operation.

A 57-year-old man, suffering multiple fractures and blood vessel and nerve damage in an accident, was left with a functionless lower arm with no feeling. On discharge four weeks after surgery he was using the terminal device and elbow lock satisfactorily.

Dr. Sarmiento says an advantage of an arm prosthesis over a leg device is that it is not required to bear weight, reducing the possibility of stump damage as a result of excessive pressure.

Price-tagging our bodies

Your nose's smell-ability is worth only about three percent of your total body functional value, according to a guide worked out by the American Medical Association. Purpose of the guide is to place loss of function on a "percentage of whole man" basis and thereby simplify the judge or jury's task of determining damages in compensation claims and civil suits.

Loss of a little finger tip rates a two percent impairment, loss of the arm at the shoulder, 60 percent and at the elbow, 57 percent.

Loss of a kidney is rated a 10 percent impairment, provided the second kidney is healthy. The figure offers some insight into how much a loss a donor undergoes in giving up a kidney to a transplant patient.

A former president of the American Trial Lawyers Association disagrees that percentage ratings would simplify jury deliberations.

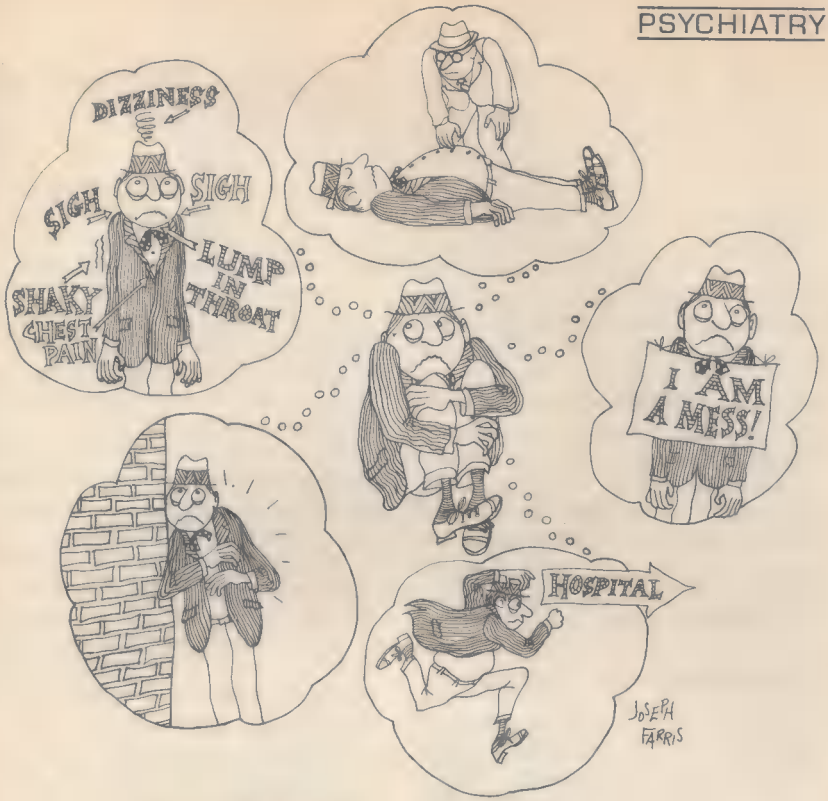
"A jury wants to know what activities an unstable knee will prevent or make more difficult, rather than being told that the knee injury amounts to a five percent permanent functional disability of the body as a whole," said Samuel Langerman of Phoenix, in discussing the guide before the 1969 National Medicolegal Symposium.

A severe hand injury or loss of fingers might totally disable a violinist but have no effect on the career of a school teacher or lawyer, he points out.

A loss of smell may mean much to a cook or to one working in a factory where the ability to smell noxious fumes might save his life.

"Similarly, to describe a hip injury or knee injury or ankle injury in terms of percentage of loss of function of the human body may be totally unrealistic when applied to someone whose occupation required him to climb ladders or work high," Langerman said.

The lawyer declared that medical experts and other witnesses will be of more help to a jury if they describe in lay language the problems the plaintiff is having and those which he is likely to have as a result of his injury.



ANXIETY:

the cheap neurosis for everyone

by Roger Signor

THIS HAS BEEN CALLED the age of anxiety—and with good reason. Tranquilizers have become almost as commonplace as aspirin in the typical medicine cabinet, and each day doctors hear a multitude of physical complaints which were probably triggered by anxieties.

This undercurrent of everyday anxiousness tends to obscure a widespread psychiatric problem. It affects millions of people and has been known by many names, including anxiety neurosis, neurocirculatory asthenia and effort syndrome.

Dr. Paul Dudley White and associates at the Massachusetts General Hospital and other investigators have done outstanding research during the past 25 years in clarifying the condition. Last December, Dr. Ferris N. Pitts and Dr. James N. McClure of Washington University's psychiatry department reported in the *New*

England Journal of Medicine that they had carried out a research project which is the first to show that the symptoms of the condition can be induced by a chemical. They prefer to call it anxiety neurosis. This was the initial research step that points to a possible physiological basis for the affliction.

The symptoms of anxiety neurosis are many, but the work of physicians such as Dr. White and Dr. Pitts has revealed a definite syndrome. There also is strong evidence that the condition is hereditary. Before giving detailed information necessary for diagnosis of anxiety neurosis, Dr. Pitts reads to his medical school classes an essay from the *Saturday Review* by Goodman Ace, who is an expert on the subject.

Hypochondriacal symptoms

"My symptoms were simple, really, and will no doubt find identification in many hypochondriacal minds," Ace wrote in 1964. "At any given moment and all through any day or night I could develop a rapid heartbeat and pulse that triggered a shortness of breath accompanied by a fear of dying. It was not so much the actual fear of dying as it was doing it unattractively; lying prone on a strange, busy street somewhere or slumped in a theater seat, or in a restaurant or a crowded elevator. . . . It is with the purpose of demonstrating that there is an art to handling hypochondria with grace and dignity that this piece is being written. Fainting in nightclubs, regurgitating in taxis, leaning against tall buildings, are not accepted *savoir-faire*. I know. I was there, Charlie. I was a mess."

Ace went on to say that he was most fortunate in finding three doctors who independently diagnosed his problem as neurocirculatory asthenia, or anxiety neurosis, and that he would be forever grateful for their considerate attendance, although they could not cure him.

Having the problem properly diagnosed, however, is a big step. It is a nightmarish experience for an anxiety patient to go from doctor to doctor only to be told perfunctorily, "There's nothing physically wrong with you." One of Dr. Pitts' patients, Gerald Mulkey of South St. Louis, last February described for a gathering of medical students just how frightening this experience could be.

His symptoms began 22 years ago when he was living with his wife and two small children in San Francisco. Through all of the following, he managed to work steadily and raise a family.

"I started to get ready for bed one evening," Mulkey told Dr. Pitts' students, "and the first thing I was aware of was a pain in the center part of my chest. It was vague at first, but then it spread around my chest and got worse. Next, I felt palpitation and then I had difficulty in breathing. I got up and started walking around, trying to get my breath. I became frightened and thought I was having a heart attack. Then I got panicky. I didn't know what to do. I just kept pacing back and forth. Finally, I had some coffee, and after an hour or so, my symptoms abated —I found it easier to breathe and my chest pains were not quite so se-

Reprinted with permission from Washington University Magazine © 1968.

The common plight of the anxiety neurotic is that the doctors all tell him he's healthy.

vere. But I didn't go back to bed again. I sat up all night."

The symptoms kept recurring every week," Mr. Mulkey continued. "It was getting so I was having these attacks about once a day, sometimes twice a day; at the most, I'd go a day or so without an attack. I just couldn't figure out what brought them on and I started to make the rounds of San Francisco doctors. I went from one to another and it was always the same. They listened to my heart, took my blood pressure—the usual routine—and they all gave me the same answer: There was nothing wrong with me. I came to the conclusion that I had an incurable heart disease and the doctors just didn't want to upset me by telling me."

One night I came home from work and told my wife that if I had to die, I wanted to die among friends and relatives in my home town. So in three days I had sold everything and we moved back to St. Louis. The attacks continued, of course, and I started the round of doctors here. And I still got the same answer. My heart was sound and they could find no reason for the attacks.

"I had reached a point where I would become panicstricken when I had an attack. I literally would jump off a bus, terrified that I was going to drop dead. It embarrassed me to think I might die in front of a lot of strangers. One night at home, I jumped up and ran six blocks to a hospital. I didn't think about it, of course, but that was a dandy thing to do if you were having a heart attack. But I had to get to the hospital. I ran up to the front desk and asked where the nearest doctor was. The nurse pointed to a room, so I went right in and told the doctor, 'I'm having a heart attack!' I can laugh now, but I wasn't laughing then. The doctor checked me over. He was very nice about it and eased me into the idea that I had an emotional problem and should see a psychiatrist. He was the first doctor I'd seen who suggested this. I took his advice and made an appointment with a psychiatrist. I'm not going to drop dead, I told myself, I'm just losing my mind!

"The psychiatrist talked to me about an hour, mainly getting background. Then he told me that he'd see me again in two weeks. Right after that visit, I had some severe attacks and I called him to tell him I couldn't wait two weeks. He suggested that I enter a hospital 'for a rest,' and I was all for that.

"Well, I didn't get the rest. When I entered the hospital, the attendants locked a big door behind me and it didn't take me but a few seconds to realize where I was. I made up my mind that if I weren't crazy to begin with, I'd lose my mind if I stayed in that place. I had had enough of the psychiatric world for the time being. But, later on, I began to look around again on my own for a psychiatrist and I was referred to Dr. Pitts."

That was eight years ago. Now fifty years old, Mulkey says: "If I knew then what I know now, I'm sure my attacks would have been milder because of the very knowledge of what they really were." He emphasized that it took several con-

versations with Dr. Pitts before he accepted and understood his condition and became convinced that his symptoms did not mean that he was going to die of a heart attack.

Dr. Pitts, an associate professor of psychiatry, who conceived the recent chemical tests in the department of psychiatry, pointed out that making a diagnosis of anxiety neurosis is a complex matter. Some of the symptoms exist to a degree in normal people who are under stress; for example, in soldiers under siege or in medical students under the strain of final exams. Using the guidelines established in studies by Dr. White, other clinicians, and his own experience, Prof. Pitts used the following criteria for diagnosis in his very rigorous testing last year of anxiety neurotics. To qualify as one, the patient must have had:

1. Frequent "anxiety attacks," that is, acute episodes of extreme fearfulness such as a feeling of impending doom, fear of insanity, fear of having a heart attack or other serious affliction; in addition, the attacks include at least two of the following symptoms: difficulty in breathing or getting a full breath; smothering or choking or struggling to breathe; sighing; chest discomfort or chest pain and a lump in the throat; plus at least three of the following: dizziness or giddiness; faintness; weakness; fatigue; inward shakiness; tremor; tingling sensation in the skin; vascular throbbing and palpitation.

2. Severe feelings of tenseness nearly daily for at least two years immediately before the interview for the tests.

3. On occasion, at least ten of the following symptoms: headache, dizziness, blurred vision, chest pain, palpitations, difficulty in breathing—breathlessness, sighing, tiredness-fatigue, easy fatigability, tingling sensation in the skin, depressed mood, trembling, shakiness, weakness, fears and insomnia.

4. No other psychiatric disease or serious medical disorder affecting heart, lungs, liver, kidneys or neuromuscular function.

It is extremely rare to find a patient in whom the onset of the symptoms of anxiety neurosis occur after the age of 35, so the age-ceiling in the Pitts' experiment was set at 30 years.

Chemical tests supported

The results of four independent studies in four nations prompted Dr. Pitts to conduct his chemical test. They all showed that anxiety neurotics, when placed under standard exercises, produced excessive amounts of a key body metabolic chemical. Also, their anxiety symptoms often developed with an increase of the substance. This substance is lactic acid, produced in sugar metabolism in body tissues. People with serious organic disease develop high blood lactate levels after exercise. In each of the four investigations, the anxiety neurotics produced the same blood levels of lactic acid.

During exercise the muscle tissue produces lactic acid, which then flows into the bloodstream where it is carried to the liver. The liver in turn removes the lactic acid and rebuilds sugar molecules which are returned to the bloodstream. (This function was first elucidated by Carl and Gerty Cori of Washington University.) In patients with liver disease

In medical tests conducted, anxiety neurotics produce high levels of a key metabolic chemical.

this unique clearing process of the liver is defective and excessive lactic acid is produced. Liver function was found to be normal in anxiety neurotics, however, and Dr. Pitts reasoned that their increased levels of lactic acid might be due to some specific mechanism.

Dr. Pitts decided to find whether lactate injected directly into a patient would produce symptoms of anxiety neurosis. First he did a pilot study, then selected 14 patients and 10 normal "control" individuals for his test. "Each of the patients and control subjects was told only that we were studying the effects of elevating the blood level by infusion of certain sugars normally present in the body; that neither they nor the physician administering the solution would know if any solution were expected to produce any particular effect; that they were to report anything they noticed to the physician in the room and to answer his questions," Dr. Pitts explained.

The attending psychiatrist knew nothing of the purpose of the test and was not told anything about the subject. Separate bottles of sodium lactate, sodium lactate with added calcium and ordinary glucose in saline were infused into the subjects' veins in a variety of orders. In this "double-blind" study the response on the part of the anxiety neurotics to the pure lactate acid was dramatic. They all witnessed the symptoms of an anxiety attack.

"Very nervous and chest tight," said one patient. "Breathing uncomfortable, vision not well focused, very unpleasant, had this kind of attack once at work and they had to take me to the doctor—just like this only I'm not as scared this time because you're here and you wouldn't let that fluid in my vein harm me."

All but two of the normal controls experienced only a few symptoms, but felt somewhat uncomfortable from the pure lactate. The two exceptions however, described extreme anxiety reactions, feelings which they had never experienced before.

All the subjects were able to differentiate the effects of the three solutions given them. The reaction to the sodium lactate with added calcium was significantly less in both patients and normal subjects. None of the subjects developed symptoms from the glucose solution; this fact made it clear that simply receiving a bottle of fluid in the arm does not cause anxiety symptoms in either normal adults or anxiety neurotics.

Most important, for the first time the symptoms of anxiety neurosis were reliably and predictably induced. A new area of research was opened in biochemical psychiatry.

"We're just beginning," Dr. Pitts pointed out. The fact that the two normal subjects had marked anxiety attacks, for instance, may indicate that the mechanism producing the symptoms is a general one, and that anxiety neurotics may simply be more susceptible to its effects. Symptoms of anxiety neurosis also occur in patients with the depressive illnesses, and Dr. Pitts would like to see whether the tests produce different responses to these individuals. At

the same time, the studies in metabolic processes that lie ahead are complex. The biochemical mechanism which apparently produces the anxiety attack is far from being known, and until it is, biochemical control of the condition cannot be attempted.

It is known that a highly significant number of people have anxiety neurosis as their primary medical complaint. Estimates are that they represent about five percent of the population, or as many as 10,000,000 individuals in this country alone. That would make this hereditary disorder the most common single medical ailment. "These people, although they are constantly nervous and have anxiety attacks, seem to be conscientious and manage to carry on their work," Dr. Pitts said. Despite the anxiety neurotic's terrifying and depressing symptoms, he does not commit, or even attempt, suicide. "He is just not that kind of person," Dr. Pitts added.

But there is no question that the anxiety neurotic suffers. Generally, the attacks strike him frequently and irrespective of circumstance, although stressful situations sometimes tend to trigger them. While the patient somehow manages to get by, the condition certainly doesn't help him. Life is difficult enough without the constant fear of keeling over from a heart attack. Tranquilizers only alleviate the secondary symptoms of anxiety neurosis but do nothing for the basic symptoms.

Once a patient is properly diagnosed as an anxiety neurotic, the most effective medicine at present is simply reassurance and moral support, Dr. Pitts stated. This therapy has worked with Mulkey and numerous other patients, who reiterate ". . . if I only knew then what I know now."

Supportive therapy certainly is better than a terse, "There's nothing wrong with you." In his humorous, but telling, style, Goodman Ace described how it felt to be left without the support of a sympathetic physician. He wrote:

"To these three learned men of medicine I will forever be grateful: Dr. Jack Weiner, Dr. Joseph Diamond and Dr. Foster Kennedy, who, at their untimely passing, I felt were somehow in violation of their Hippocratic oath. . . . One day I was in the office of one of the new doctors who had X rayed me and turned my stomach inside out. For fear he might dismiss me as having nothing wrong with me, I confided that what I had was neurocirculatory aesthenia. To my delight he nodded his head. The symptoms, he told me, were a rapid heartbeat and pulse.

"Needless to say, I was shaken. I asked if he could give me something for that. He wrote a prescription. I stuck it in my pocket and walked out. At the first drugstore I approached the pharmacist, took the prescription out and was about to hand it to him when I read what the doctor had written: 'You have no organic abnormality of the heart, no feeling of breathlessness is dangerous, nothing bad will happen to you.' And he had the nerve to sign it. I ordered a tube of toothpaste, small size. I knew now I wasn't going to last long."

For further reading

MAN, MEDICINE AND ENVIRONMENT. *Rene Dubos. Frederick A. Praeger Publishers. 1968*

Spot check for fluoride safety

HAS the proper amount of fluoride been added to the municipal water supply to prevent tooth decay? Or has nature put in too much? A scientific instrument enables officials to monitor or spot check the content for either reason.

An electrode that produces an immediate reading on a dial was recently patented by Dr. Martin S. Frant, an organic chemist, for Orion Research, Inc., of Cambridge, Mass.

The sensing element is a single crystal of lanthamum fluoride, or another rare earth fluoride. The charges that move in the crystal are fluoride ions, rather than electrons. The electrode has been discussed in more than 30 articles in scientific journals.

In dental research, the electrode is used to study the rate at which fluoride leaves the mouth after a brushing with fluoridated toothpaste. Using a modified version, scientists at the Woods Hole Oceanographic Institute have made a continuous record of fluoride content in the ocean depths.

Too much fluoride in air or water can endanger plants and aquatic life. Government officials and industrialists use the electrode to watch for such pollution in rivers into which wastes are discharged and in air escaping from the factories.

In the aluminum industry, workers' urine is regularly analyzed with the electrode to insure that they have not been exposed to dangerous levels of fluoride.

Since the instrument was introduced in 1966, about 3,000 have been sold to laboratories and other users around the world. John H. Riseman, president of Orion Research, has predicted that the device will within another two years replace all other means of measuring fluoride.

No. 3,431,182 is the first of Dr. Frant's patents to be assigned to the company, which he joined in 1964. He is associate director of research.

—Stacy V. Jones

"Who needs it? You've been hearing strange noises for years without any extra help."

Tea power

Illustrations Bettman Archive

The ancient drink that has been enjoyed by monarchs and peasants alike has never been more popular than today. Brewing it has always been an art, but only very recently has it become a science. Tea-tasters like the gentlemen above have now become biochemists.

by John C. Pavlik

EVERY MORNING, from 9 to 10 a.m., three distinguished-looking men start the day with some serious drinking at their usual position in front of a long bar in Englewood Cliffs, N. J. Nothing compulsive here; it's just daily work for three professional tea-tasters at Thomas J. Lipton, Inc., and they rank among the most sophisticated analytical instruments in a major industry. Tasters at Lipton never swallow the sample but draw it into the mouth violently with a loud slurping sound (this gives them the full effect, simultaneously, of the brew's aroma and flavor); then, if you'll pardon the expression, they spit. In Ceylon, another major "school" of tea-tasting is based on a gargle rather than a slurp.

Across the hall is still another as-

pect of tea instrumentation. Here a modified fluoro-microphotometer is used in a new method Lipton researchers developed for the rapid, reproducible measurement of haze in instant tea. Transmission and scatter are measured successively, and *automatically*, within 30 seconds—independent of the absorption effects of the color. (Already, the instrumental method developed for Operation Tea is being considered as a means to study bacterial growth rates and the efficiency of filters.)

Other instrumental colleagues of the human tea-tasters and the not-quite-human fluoro-microphotometer —spectrophotometers, colorimeters, gas chromatographs, paper chromatographs, thin-layer chromatographs, radioisotope set-ups—supply data to supplement the tea-tasters' analytical judgment when decisions are made concerning purchasing and blending. The tea business, long considered an art, is now, after 4½ millenia, almost a science.

The tea calendar begins with 2737 B.C. when, as the l e g e n d goes, leaves from a woodland shrub fell into the campfire pot of the Chinese philosopher-emperor, S h e n-n u n g. The concoction emitted such a pleasant aroma, the philosopher ventured a sip. He found the flavor exhilarating and spread the word.

So much for legend. One thing is certain: China had been afflicted with floods and epidemics from the earliest times. Eventually, the court physicians came to realize that the floods were carrying infectious debris into the water supply and forced the government to decree that all drinking water must be boiled. The merit of this chore was soon evident, but so was the resultant tastelessness. The more inventive housekeepers started to flavor the bland water with leaves, berries and seeds. Among these: tea leaves.

Eventually, tea and Chinese medical practice became inseparable. Arthritis and dropsy were habitually treated with tea as beverage or poultice. Since tea stimulates the kidneys, tea was indeed an apt prescription for dropsy, which is an accumulation of liquid in the body. Physicians simply supplied their patients with the leaves and instructed them in their use. This practice, passed on from generation to generation, has come down to us as tea drinking, a phenomenon that represents one of the more unique evolutions in civilization: from medicine to accessory food.

In every country where it was introduced, tea was adopted almost unanimously. Staunchest fan: England. By the 17th century, tea was sold on every street in London; a century later, the clamor for tea had become so great that the famous coffee houses became, to all intents and purposes, *tea* houses. One frequent visitor, author S a m u e l Johnson,

Reprinted with permission from The Laboratory, © 1968 by Fisher Scientific Co.

Victorian scenes like this one were common in the last century, in Europe as well as America. Tea time was a time of quiet conversation and relaxation. Today the emphasis is on speed and convenience; now it's instant tea and TV.

would down 16 cups at a sitting.

Today, Britain still imports the largest volume of tea in the world. Her average citizen drinks five cups a day, and London, her largest metropolis, is tea capital of the world.

Tea's appeal can be traced to the stimulating effect it has on the human nervous system. Tea is also popular because of its versatility: it can be served mild or robust, steaming hot or ice cold. Both refreshing and thirst-quenching, tea is so economical that it competes easily with the ubiquitous "soft" drinks. Last year, 2,500,000,000 pounds of tea—bagged, instant, fruit-flavored (grape, orange, lime), concentrated, low-calorie, even loose—went into cups and glasses the world over.

One reason for the upward consumption is the laboratory revolution of the last 20 years. Researchers have improved tea so that quality has never been better or more uniform. And tea has never been so convenient to use. The height of convenience are cold-water-soluble instant teas for iced tea and the "formulated" teas with powdered milk (or lemon) and sugar already added. Tea research is carried out in all major producing and processing countries, including Ceylon, India, Japan, the U.S. and Russia.

An outstanding example of how tea research catalyzes progress in the industry is offered by Ceylon, which began cultivating tea in 1867 after the threatened extinction of its coffee plantations by coffee rust. Within 20 years, this determined nation completely replaced one major crop with another—a feat rarely paralleled in agricultural history. Where its first exports totalled a meager 23 pounds, its 1966 tea exports were 500 million pounds—enough to make Ceylon the world's largest tea exporter.

Behind this success story is more than good soil, good climate and good luck. Behind it is TRI, the Tea Research Institute of Ceylon, where

fertilizers have been developed to increase crop yields astronomically . . . where new herbicides, pesticides and fungicides have been formulated to meet peculiarly Ceylonese needs . . . and where tea plant species have been tirelessly hybridized to unite the best features of each.

Recently TRI researchers (as well as tea researchers throughout the world) have been concentrating on the complex biochemical changes that take place in the leaf during processing. Their aim: to discover precisely what chemical constituents are responsible for tea flavor, aroma and quality. Early data derived from these investigations enabled TRI to produce a soluble instant-tea powder from green leaf in 1959. This was a landmark for the entire industry, not only because a new type of instant tea was produced but because a new tea process was used. There are three general types of tea; each starts with the green leaves but as a result of complete oxidation, semi-oxidation or no oxidation during processing, the tea becomes, respectively, a black, Oolong (light brown), or green end-product. The steps for orthodox black tea processing are plucking, withering, rolling (bruising the leaves to release enzymes), fermentation and drying. TRI ingeniously modified this process to eliminate the drying stage.

Heretofore, instant tea was manufactured in the U.S. and Britain from black tea brew that was evaporated to a powder. This pioneer method had one major disadvantage: it gave the highly vulnerable tea liquors time to deteriorate. It was to correct this problem that Ceylon made *its* instant tea extracts from leaves that the chemists hadn't permitted to complete the conventional processing procedure. This new method, along with controlled oxidation and extraction, assisted in the preservation of flavor in instant tea.

Now, if instant tea were used solely as a *hot* beverage, the technical requirements for its manufacture would be far less demanding. But iced tea poses difficulties—even slightly hard water at low temperature will delay or prevent solution, cause unesthetic clouding, even, sometimes, settling of solids. This last phenomenon is called "creaming"; it's been traced to a loose complexing of high-molecular-weight compounds with caffeine. Because an instant tea intended for iced tea preparation must be modified to overcome these creaming tendencies, its manufacture is much more complex than that of instant coffee.

The challenge for the tea industry today is to manufacture an instant tea that has a flavor, aroma and color equal to that of hot brewed tea. The

direction of research seems to be following the Ceylon experiments with undried leaves.

In Ceylon, as elsewhere, research groups are oriented either to basics or to applied aims. In the U.S., at Coca-Cola's Fundamental Research Department in Linden, N. J., investigators have identified 83 aromatic constituents in black tea from the volatile fraction, which represents only 0.01 per cent of the leaf's dry weight.

An object of much research

At the A. A. Bogomoletz Institute of Physiology in Kiev, Russian researchers have used compounds derived from tea (vitamin P and tea catechols) to immunize mice against X rays. In London University's Queen Elizabeth College, tea infusions are used to decrease serum cholesterol in rats . . . and in the U.S. a patent has been granted for a cigarette filter that utilizes dehydrated tea.

Chemists at the Institute of Technological Research in Bogota, Colombia, have already provided a solution to one of the principal defects of tea—its rapid aging. Their answer: lyophilization, or freezing under high vacuum.

Another object of current research is the humble tea bag. It must not affect tea flavor in any way, must have maximum porosity and, above all, a tremendous wet strength.

Some U. S. chemists are treating tea bags to achieve this extra strength. The papers are coated with alkyl polysiloxanes, then baked; this produces bags that can withstand any excess pressure that might build up in a tea bag, even when immersed in boiling water and poked by an impatient commuter. Water exchange remains good, and non-toxic silicone resins do not affect flavor or taste.

What lies ahead for the world's bottomless tea cups? Tea scientists predict that increased understanding of the biochemical changes behind tea quality, aroma and flavor will soon enable them to produce teas with desirable tea characteristics all through the year, not just seasonally. Through strict biochemical control of the processes of withering and oxidation, the desired quality, flavor and aroma will be imparted to leaf grown at any altitude, in any season.

New technology based on laboratory data will also bring continuous-flow factories that will handle tea from the beginning of processing to the final packaging, automatically. (There are reports of prototypes in operation in Russia.) There will even be electronic testing, by instrumental analyzers. The results of these objective tests will be fed into computers, which will offer readout in terms of TV ("tea value").

However, it may be some time before those three gentlemen in their handsome regimental ties are eased out from in front of the long bar in Englewood Cliffs where they taste today's experimental blends.

True, they don't have a single transistor or dial or meter among them. But, oh, those taste buds.

For further reading

THE ROMANCE OF TEA. *William H. Ukers. New York. 1936.*

TO THINK OF TEA! *Agnes Reppler. Boston 1932, London 1933.*

Modern geographers aren't concerned with merely studying boundaries and names of places. Like the men here, their job may take them to the poles, to help plan nuclear power stations.

Fascinating new careers in GEOGRAPHY

Don't confuse modern geography with what you learned in grade school. It's now a wide-open field that offers intriguing work, travel, high adventure and high salaries.

by Creighton Peet

WHAT DO YOU call a man who is trained to work as a consultant to an oil company or a department store chain, or as a highway planner, a travel agent, a college professor, a weather expert for a TV network, a Washington consultant for the Air Force or the Department of Agriculture, a member of the New York City Planning Authority, a map maker, an advisor to a big printing outfit or a special attache in a U.S. Embassy in some foreign land? Answer: a geographer.

When you say geography today, forget the old grade school habit of rattling off the names of the states, the products of Brazil and the height of Mt. Everest in feet, kilometers, etc.

A geographer (who has first earned an A.B., often an M.A. and sometimes a Ph.D.) is very little concerned with the mere facts of shorelines, mountains and r i v e r s. He wants to know what goes on all over the globe and even on the moon. What kinds of people live in a given

area, where do they get their food, what roads, railroads and airlines serve them? Where do they get their oil, coal, timber, ores? A geographer also wants to know what kind of soil they have, which crops grow best and the population of their cities. He wants to know something of a people's traditions, customs and history. Are they thriving or are they losing their vitality?

A geographer always thinks of the future. While an engineer is designing a big bridge, for example, the geographer is studying its location and the effect it will have on the towns and the people at either end. Will this site be the best for people—or should it be built a mile or two up or downstream? While it may enable one town to send its products to market more easily, will access to a new community starve the smaller town when everybody shops in the larger one? Will the approach roads block streets, creating hardships?

A great percentage of geographers teach either in high schools or colleges today, but this will not always be so. They are beginning to be in terrific demand for all sorts of industrial and government jobs. And urban development is a very active field today. Even small cities very often have active planning staffs which may include a geographer.

One of the basic fields for a geographer is as a cartographer or map maker. In a time when wars and the creation of new countries make maps obsolete overnight, geographers in the editorial offices of map companies follow the news as closely as the men in newspaper offices. The Hammond Map Company in Maplewood, N.J., which has a dozen geographers on its staff in addition to a roomful of draftsmen, makes about 2,000 changes in its basic atlas every year. Some 20 towns appear or disappear every week, all over the world.

In printing a new map a deadline is set after which no more changes will be made, no matter what is involved. After President Kennedy was assassinated, a great number of towns, roads, parks and dams were named for him. And when Stalin and Khrushchev went out of favor, scores of changes had to be made on maps of Russia.

Also, cartographers have to deal tactfully with sensitive national pride. For over 100 years Great Britain has claimed the Falkland Islands off the coast of South America, and so has Argentina. To sell in South America, maps must show these islands as belonging to Argentina; maps in English show British ownership. Arab countries will not tolerate maps which show Israel, and not long ago one of them seized a shipment of Hammond's inflatable plastic globes and with scissors simply cut out Israel entirely.

Martin Bacheller, editor in chief of the Hammond Company, says that cartographers long ago learned that an atlas is always judged by the ease with which a man can find the name of the town in which he was born. Making some changes on the big revolving globe in the lobby of the Daily News Building in New York, one of this company's geogra-

Today's geographer may help plan towns, roads, dams, railroads. He's a vital cog in every industry.

phers was heckled for days by a man born on Gozo, a tiny island near Malta in the Mediterranean, because it doesn't appear on this globe at all.

Today geographers produce an enormous variety of maps which show many different things about an area. Over a basic map showing shore lines, national boundaries, rivers and lakes, a series of transparent plastic overlays, often in color, can add roads, railroads, major crops, electric power grids and gas and oil pipelines. For use in schools, overlay maps can show historical changes—or geological features. Special maps are of course invaluable to commercial firms, but these are usually made by the companies involved.

While geographers are still fairly scarce in the business world, they are increasingly in demand by large companies as expansion and more comprehensive research are undertaken.

Take for instance Michael McGilvray, geographer for the May Company, working out of its St. Louis headquarters to investigate location possibilities for new stores. "In the old days," McGilvray says, "planners would just drive around a neighborhood and talk to a few people to get the 'feel' of things—and perhaps hire a man to stand on a street corner all day and count the number of people who passed by to decide on whether it would be a good place to locate a store. But today land and buildings are so expensive, companies feel they need much more expert, in-depth information.

"So in my job I study the whole area around a possible site. How far will people drive to shop? Which are the nearby towns with the greatest population growth potentials? Are the highways good, and are better ones planned? Then there's what we call the 'social distance.' Why will families out for a day's shopping pass by one location in favor of another? Maybe if a man is in a certain income bracket he will feel that his family should patronize a certain store even if it is at a greater distance. It takes from five to seven years to decide where you're going to put a regular store. This may be a location where there aren't even any houses yet. However, it takes a much shorter time to decide on a location for a discount outlet. These are newer and have their own built-in attraction. People will search them out.

"Since I accepted this job," McGilvray says, "I've had offers from two railroads and a utility company. One thing about geographers—they're never out of work. And college professors teaching geography usually earn from $15,000 to $17,000 for a nine-month year—which is pretty nice."

As for background, McGilvray got his A.B. from the University of St. Louis—and then his M.A. After two years at the University of Cincinnati, he is about to complete his Ph.D., when he finishes his dissertation.

Geographers who choose to stay in the academic world find there are plenty of grants from foundations, governments and universities to do research projects all over the world.

Newton Rose, a graduate student at Columbia, recently spent several months in Brazil researching the food supply, medical care, population data and climate.

Bob Brown, now teaching at Rutgers University, has just returned from Libya where he studied the effect the presence of the big oil companies has had on the life and economy of the native population.

Prof. William A. Hance, chairman of the geography department at Columbia University, recalls that in 24 years he has made 14 trips to Europe and six to Africa.

Extensive travel

Donald A. Measner, another geographer now teaching at Briarcliff College, has spent a great deal of time in Turkey studying the results of the introduction of a cash crop (sugar beets) in an area with a strong tradition in primitive, inefficient farming going back thousands of years. On a long range basis, say five or six years, Measner is following the introduction of new crops and methods in 300 farms in Turkey.

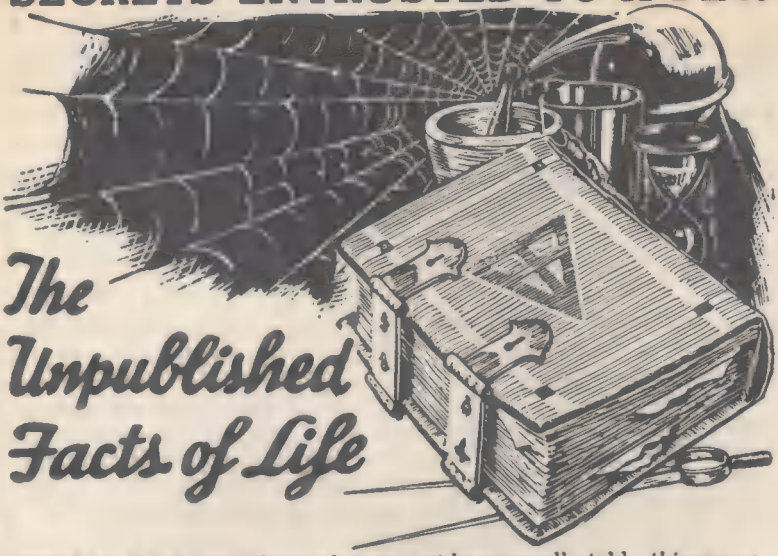
And Prof. Russell White of the geography department at Hunter College in New York, recently spent six months, partly financed by the Mexican government, studying primitive migrations in northern Mexico. From this work researchers have concluded that Mexican civilization may have extended as far north as the present state of Arizona. Prof. White strongly advises all college students majoring in geography to spend their summers out in the field, taking a job with an outfit such as the National Park Service. As you trek over an area you get a great deal of invaluable first hand understanding of geographical features. And you may make interesting archaeological discoveries—men in the National Park Service often do.

Leading organizations in the field of geography are the Association of American Geographers in Washington and the American Geographical Society of New York, which issues a number of periodicals. The wide variety of subjects which this society's quarterly *Geographical Review* covers in a typical issue is surprising. Some recent ones covered the deforestation of Mt. Lebanon, human diets in Guatemala, population origins in Texas in 1850, the difference in railroad gauges in all parts of the world and a report on an unusual beach in Tanzania on the Indian Ocean.

If you think geography might be for you, a 95-page booklet issued by the Government Printing Office in Washington ("Geography as a Professional Field") and selling for 35 cents will be a big help. It gets into every aspect of this work and lists 16 specific fields in which you can specialize. It also has a list of colleges which offer undergraduate majors in geography.

Invaluable to a student considering this field is JIG, or Jobs in Geography, issued by the Association of American Geographers at 1146 16th Street, Washington, D.C. 20036 ($1 a copy). Openings are described in detail and give education needed and often salary offered. A recent issue listed some 70 academic openings and 20 in business, at salaries ranging from $5,800 to $18,000. Also listed were almost 50 Federal jobs in all states paying from $5,700 to $25,000.

SECRETS ENTRUSTED TO A FEW



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THERE ARE some things that can not be generally told—*things you ought to know*. Great truths are dangerous to some—but factors for *personal power* and *accomplishment* in the hands of those who understand them. Behind the tales of the miracles and mysteries of the ancients, lie centuries of their secret probing into nature's laws—their amazing discoveries of *the hidden processes of man's mind*, and *the mastery of life's problems*. Once shrouded in mystery to avoid their destruction by mass fear and ignorance, these facts remain a useful heritage for the thousands of men and women who privately use them in their homes today.

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QUIZ

How good are you as a meteorologist?

by John and Molly Daugherty

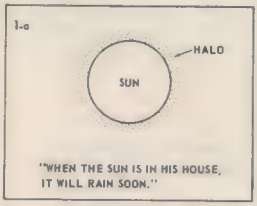
YOU QUALIFY as an amateur meteorologist. You've been observing the local weather all your life. Probably you know the weather in your immediate environment better than the experts do.

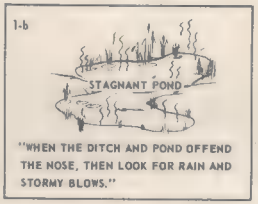
True, the professional meteorologists have all sorts of scientific instruments and data to give them a picture of the weather on a grand scale—even global. (See "Satellite Weather Forecasting," *Science Digest*, May 1969). But you have eyes, skin and nose to help you detect the wind, clouds, humidity and temperature. So you are, in a way, a walking weather observatory.

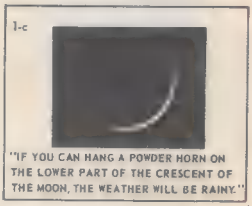
What do you know about meteorology?

1. Long ago man had only weather lore to help him predict the weather. Strangely enough, many of them had merit, but usually they were based on only one weather factor instead of many.

Choose the picture which shows *no* basis in fact for predicting the weather.

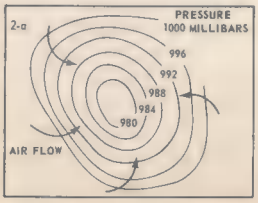


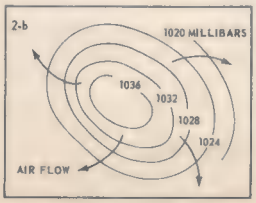


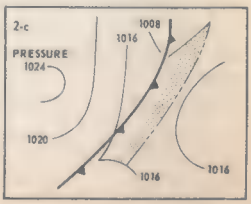


2. Centers of low pressure called cyclones are marked *Low* on weather maps. Centers of high pressure called anticyclones are marked *High*. Both *Highs* and *Lows* have a characteristic direction of flow of air about the center. In the Southern Hemisphere the directions of flow are reversed.

Choose the picture that shows a *Low* or cyclone in the Northern Hemisphere.

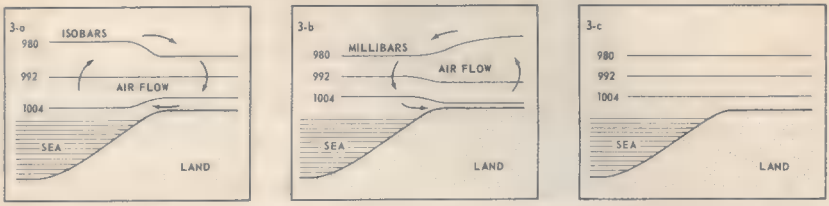






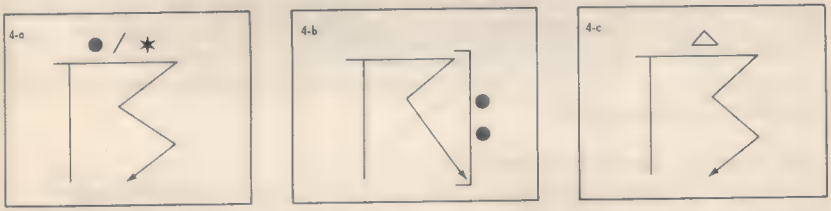
3. The unequal heating of the land and the sea may set up local winds. If a general wind is also present, the local land and sea breezes will be superimposed upon the general wind.

Choose the picture that shows on warm days the circulation of the air.



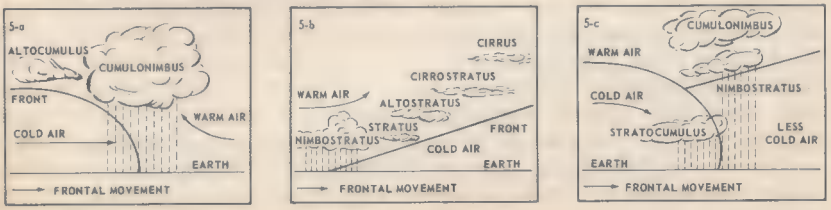
4. The Weather Bureau under the U.S. Department of Commerce publishes a daily weather map with coded symbols for the various weather factors. The present state of the weather table shows one hundred different symbols. For example, there are ten symbols for specific types of thunderstorms. The general symbol is like an "R" with various embellishments to show the varieties.

Choose the picture that shows a *heavy* thunderstorm without hail, but with rain and/or snow at the time of observation.



5. When two huge masses of air with unlike properties meet, the boundary between them is a weather *front*. The air masses are so large there is little chance for mixing when one overtakes the other. The three basic types of fronts are warm, cold and occluded.

Choose the picture that shows a warm front.



Drawings by Sam Sims

Answers:

1-c The shape of the phases of the moon has no bearing on the weather. This proverb sometimes is expressed in another way: "If the horns of the moon point up, the moon can hold water, and it will rain."

In 1-a the halo around the sun is really in the earth's atmosphere—high cirrostratus clouds, usually associated with stormy weather.

In 1-b stagnant ponds contain decaying organic matter. With an approaching storm, the accompanying decrease in air pressure makes the escape of foul odors from the water a little easier.

2-a This diagram shows a *Low* or cyclone in the Northern Hemisphere. The air pressure in millibars progressively decreases from 996 in this case to 980 at the center. The air moves counterclockwise from the higher pressure toward the center, but *not* directly so because of the effect of the rotation of the earth.

In 2-b the diagram shows a *High* or anticyclone with clockwise movement of air about the center for this hemisphere.

In 2-c there is a squall-line associated with a cold front.

3-b This is a sea breeze caused by the sun's warming the land faster than the water surface. The specific heat of land is less than that of water, so that equal exposure to the sun (on equal masses of each) raises the temperature of land higher. The air over the water being cooler than that over the land, the pressure force is in a direction from the sea toward the land.

In 3-a, a land breeze develops late at night because the earth cools off more rapidly than the sea, and the wind flows from the land to the sea.

In 3-c neither land nor sea breeze occurs during the transition from a sea breeze to a land breeze. This takes place in early evening and the reverse transition in the morning.

4-a This is a heavy thunderstorm indicated by the arrow pointing *in* at the base rather than *out*. The heavy period indicates rain, and the star, snow. It is without hail because the small triangle with its apex up (which shows hail) is missing.

In 4-b a thunderstorm occurred in the past hour but not at the time of the observation. Presently, there is moderate or heavy rain.

In 4-c there is a heavy thunderstorm with hail at observation time.

5-b Here a warm air mass overtakes a cold air mass. Since cold air is denser than warm air, the warm air slides up over the cold air. The overriding air cools in the forced ascent, and a cloud pattern in step ladder fashion develops with cirrus and cirrostratus at the highest level. If a warm front approaches you, you will see first the cirrus clouds and then successively the lower clouds altostratus and stratus before you see the nimbostratus storm clouds.

In 5-a, a cold front, the cold air pushes under the warm air, forcing it up.

In 5-c, an occluded front, a cold front pushes into a warm front pushing the warm air aloft out of contact with the ground.

Score yourself:

4-5 right You're up with the cirrus clouds
2-3 right You're an altostratus cloud man
0-1 right Your score's in a fog

ISAAC ASIMOV EXPLAINS

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the *Science Digest* staff.

What is theoretical physics?

What is a theoretical physicist and what sort of work would he do?

The science of physics deals primarily with energy in its various forms and with the interaction of energy with matter. A physicist would be interested in the laws governing motion, since any piece of matter in motion would possess "kinetic energy." He would be interested in heat, sound, light, electricity, magnetism and radioactivity, for all represent forms of energy. In the 20th century, it even became apparent that mass is a form of energy.

A physicist would also be interested in the manner in which one form of energy is converted into another and in the rules governing that conversion.

Naturally, physicists can specialize. If one of them is particularly interested in the interaction of energy and subatomic particles, he is a "nuclear physicist." (The nucleus is the chief structure within the atom.) If he is interested in the interaction of energy and matter in stars, he is an "astrophysicist" (the Greek word "aster" means star).

Then, too, someone who is particularly interested in the energy aspects of chemical reactions is a "physical chemist" and someone who is chiefly interested in the manner in which living tissue handles and produces energy is a "biophysicist" (the

Greek word "bios" means life).

A physicist may be absorbed in making careful measurements under various controlled conditions. He may want to measure the exact amount of heat produced by certain chemical reactions. He may want to measure the exact manner in which a particular subatomic particle breaks down to liberate other particles plus energy. He may want to measure the exact manner in which tiny electric potentials in the brain vary under the influence of certain drugs. In all these cases, he is essentially an "experimental physicist."

On the other hand, a physicist may be particularly interested in studying careful measurements which have already been obtained, in order to see if he can make general sense out of them. Perhaps he can figure out some mathematical relationship which would explain why all those measurements are what they are. If he works out such a mathematical relationship, he can use it to predict the values of other measurements that have not yet been made. If these measurements, once made, turn out to be as predicted, he may well have advanced something that is often called a "law of nature."

Physicists who try to work out laws of nature in this way are "theoretical physicists."

There are some superbly gifted experimental physicists who are not particularly interested in theorizing. Albert A. Michelson, who invented the interferometer and made accurate measurements of the speed of light, is an example. There are also superbly gifted theoretical physicists who are not at all interested in experimenting. Albert Einstein, the founder of the theory of relativity, was one of those.

Both experimental and theoretical physicists are extremely valuable to science, even if the former restrict themselves to measurement and the latter to mathematical reasoning. It is always fascinating, however, to find someone who is first-class both as an experimenter and as a theoretician. Enrico Fermi was an outstanding example of such a "double-threat" physicist. (He was also an outstanding teacher which made him, perhaps, "triple-threat.")

—Isaac Asimov

What does the law of succession mean when referred to nature?

Nature many times astounds us with her methods of operating which are nearly always superior to man's often awkward and costly ways of handling the same situation. A good example of this ability of hers is what is referred to as the law of succession, by which specific plants and trees naturally follow one another in their growing cycles in certain areas over a very long period of time.

This can be illustrated by looking at what happens to an area of land or forest that has been decimated by fire. There's a definite pattern to Nature's way of rehabilitating this land. Fireweed and fast-growing grasses are likely to be the first to grow on the scorched soil. The first trees will probably appear next, and they will most often be conifers, or trees that bear cones, such as the pine tree. Such trees need a lot of sun while young, and they'll get it in this sequence of growing plants be-

cause there are no other trees to block the sun. Once these initial trees have grown large enough to shade the meadow area, the grasses will probably die and more trees will spring up—like poplars and willows.

The next and final step in the law of succession is the "climax forest," which is made up of the tallest trees that will grow in a given area and climate. They naturally vary tremendously from region to region. Climax trees in the east are maple, beech and oak chestnut. In the Rocky Mountain region, Douglas fir, spruce and white-bark pine are the dominant trees, and in the Great Lakes area, it's the white pine also. In some parts of Texas, the tall palm tree quite conspicuously towers above everything else, while in other parts of the state the pine tree reigns supreme. The climax trees of the northern Pacific coast are white cedar and hemlock.

So, the climax forest which finally restores the barren charcoaled ground to its natural state may take as long as 200 years to develop fully. But while it is a long process, it is natural and quite efficient.

Man's way of doing the same thing, known as reforestation, is basically the same, although it doesn't take so long because man often plants seedlings which are one or two years old, getting a jump on Mother Nature. Seeds may be used, too, and frequently quick-sprouting seeds of native grasses will be planted to prevent soil erosion until the tree seeds get ■ good start. Mechanical reseeding is done most successfully after a soaking rain has washed away the ashes. The machine merely scatters seeds at specific intervals and covers them up by dragging brush over them.

Medicine on trial

Medicine on Trial. Dannie Abse. Crown Publishers, Inc. ($10.00).

Medicine on Trial is really a misnomer for this book, because it is neither a probing prosecution nor a well-constructed defense of the status of western medicine. Instead, it attempts to put the practice of medicine and its associated social problems, such as narcotic addiction, into a reasonable perspective by highlighting both the dramatic achievements and the spectacular failures that have occurred throughout the course of history.

Abse, himself a physician, begins with a sensitive and emotional introduction in which he writes of his maturation through the training years from an idealistic student, often discouraged, appalled and many times frustrated, to an aware, experienced (and still frustrated) clinician. He writes warmly and personally of the joy of delivering his first baby as well as the horror at viewing his first postmortem examination. He frankly points out the inadequacy of his training and thus his insecurity when starting practice. He recoiled from medicine's technological orientation and was disillusioned by the ignorance of his professors outside the bounds of medicine. From these very personal experiences and feelings comes the dedication to write an honest appraisal of the art and science of medicine.

Abse believes that many medical men are ignorant in the field of medical history. Probably because he believes this so strongly, the book is crammed with historical facts and adventures. He includes the drama of the life-saving discoveries of the major antibiotics, the sulfa drugs, penicillin and streptomycin.

But scattered throughout the book are invectives against the use of drugs and the profit-conscious drug industry. He criticizes the organically-oriented psychiatrists for their "cheerless optimism" concerning treatment of mental illness with as yet unproven psychochemicals. Specifically, he warns of those who are using lysergic acid diethylamide (LSD) for psychotherapeutic purposes.

Abse is similarly critical of drug research on human subjects, the biased promotions of the drug companies which often poorly represent either therapeutic efficacy or morbid side effects—and of uninformed physicians passing out potentially harmful medications when only placebos are needed.

He cites the fact that 10 to 15 percent of illnesses treated in hospitals are due to some complication resulting from a drug prescribed by a physician. He reminds us that even a "safe" drug like penicillin is responsible for 300 fatalities per year in this country. However, no one would argue that when used in proper context medicines are to a great extent responsible for the health of this country.

With an eminently readable journalistic style and a well-illustrated text, Abse brings to the lay public a reasonable, unbiased view of many of the currently controversial issues

of western medical practice. Concluding with reasonable restraint for the future he says, "A certain courage is required if we are to think of things we are not accustomed to, and it seems to me that those who are knowledgeable must not only proceed with their scientific inquiries but also, from time to time, take up responsible admonitory stances."

—*Roger L. Goettsche*

Roger Goettsche is an intern at Pacific Medical Center in San Francisco. He has just completed his fourth year as a medical student at the Columbia College of Physicians and Surgeons.

Other new books of interest

Project Icarus. Louis A. Kleiman, Editor. The M.I.T. Press. In the spring of 1967, M.I.T. offered a course to its Advanced Space Systems Engineering students, the whole purpose of which was to develop a workable plan to stop the asteroid Icarus from hitting earth in June 1968, the month Icarus was scheduled to come closest to earth—a mere four million miles away. Although the probability of Icarus colliding with the earth was highly unlikely (and it obviously did not since it is now a year later), the M.I.T. course assumed the asteroid *would* collide and proceeded from there with devising a plan to prevent the disaster. Nothing is overlooked, and though the project report gets quite technical at times, the whole thing is nevertheless intriguing. (See "The Sky Is Falling, But Don't Duck," page 14 this issue.)

Wild Refuge. George Laycock. The Natural History Press. ($3.50). While it may sound a bit corny to say it's exciting to read about how the whooping crane has been saved from near extinction by the establishment of a wildlife refuge in Aransas, Texas, or how elk have similarly benefited in Jackson, Wyo., or how countless forms of wildlife and natural marshlands have also been saved in Okefenokee, Ga., there's no denying that it is thrilling to anyone who cares about nature and conservation. The history of national wildlife refuges and national interest in conservation is a fascinating one, and the author offers a well-written and encouraging word on what's being done in this country on the many wildlife refuges to preserve wild creatures.

The Bronx Zoo Book of Wild Animals. William Bridges. The New York Zoological Society and Golden Press. ($5.95). What started out to be a handbook and guide to the animals who live at the Bronx Zoo mushroomed into a fact-filled, well-illustrated book of wildlife in general—by no means limited to the Bronx Zoo. If you've ever gone to a zoo, you've no doubt forgotten the name of some strange animal you've seen for the first time. This would be a handy reference book to keep at home, and even if you're not an inveterate zoo-goer you're bound to be interested in animals, so you'll find this a good book to have.

Homes Beneath the Sea. Boris Arnov Jr. Little, Brown and Co. ($4.50). The science of marine ecology deals with the balance of nature in the

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oceans, population densities, habitats and all the amazing things that govern life in the sea. Here's an introduction to that science written in extremely simple terminology meant for the interested beginner, with some nice illustrations.

Enzymes—the Agents of Life. David N. Locke. Crown Publishers. ($5.95). While enzymes are not a subject of exciting news value to most people, they are elements vital to our very existence, and this author presents an understandable and quite readable study of these "agents of life" and their roles in medicine and industry.

Animal Expressions. Animal Welfare Institute. P. O. Box 3492, Grand Central Station, N. Y., N. Y. 10017 (75¢). Can a lab animal be happy in its cage? Yes, says this little picture book, depending on how they're treated. Photographs of animals with shining eyes and raised heads in some institutions are contrasted with shots of the forlorn demeanor of maltreated creatures in other situations. If you think a dog or monkey can't express emotion in its face or body, this may change your mind. Warning: the plight of animals in some situations may put a lump in your throat.

1001 Questions Answered About Natural Land Disasters. Barbara Tufty. ($7.50). 1001 Questions Answered About Aviation History. C. H. Hildreth and Bernard C. Nalty. ($8.50). Dodd, Mead. Both volumes are valuable as reference books, and are two of a large series of "1001 Questions" titles. All the basic questions and answers are here—plus many that aren't too familiar.

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NON-PROFIT research: Free horoscope in exchange for date, time and place of birth, main mental interest, health problem, hobby occupation, and stamped envelope. V. Schroeder, P.O. Box 988, Battle Creek, Michigan 49016.

WANTED—MISCELLANEOUS

MERCURY-Gold-silver-platinum for cash. Circular. Ore assays. W-Terminal, Norwood, Mass.

MISCELLANEOUS

WINEMAKERS-Free catalog and recipes. Kraus, Box 451-R, Nevada, Missouri 64772.

BANK Kit check protector, bank approved check book cover, ball point pen and rooler ppd. $1. Lewis Sales, P. O. Box 123, Clarendon Hills, Ill. 60514.

CORDLESS Table lamp 6 volt battery furnishes light up to 2 years unbeatable for unlighted areas. Boats, trailers, camps. Made in U.S.A. full guarantee. $9.45 each. 2 for $18.00 postage. Sam Richards Traders, P.O. Box 456, North Shore Road, Ban Tam, Conn. 06750.

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SLOT Machines, pinball machines, etc. Catalog 50¢. Coffco, Dept. D., P.O. Box 522, Lake Zurich, Ill. 60047.

Letters to the Editor

Allergies and health foods

I read your article, "The Wacky World of Food Fads," (February 1969) with great interest since my professional duties bring me into frequent contact with health food stores. While everything you say is true, I feel that you have really not dealt fairly with these stores and that there is a real need for them.

A few years ago I surveyed 27 health food stores in five counties of the San Francisco area. In each store I said I was an allergy patient and asked for foods free of wheat, eggs or milk. In only one of these stores did I encounter any evidence of bad faith. In the others the personnel impressed me as being highly motivated and scrupulous. Unfortunately they do have to depend on the manufacturers, who are not always dependable, for knowledge of the ingredients of the foods they sell.

There is also a problem in conflict of ethics. For a baker, good professional ethics includes producing a loaf of bread which has risen well and is desirable to eat. If he can't get his wheat-free bread to rise properly, he is terribly tempted to put in a little wheat gluten on the sly. There was also some milk derivative, probably casein, in many of the "milk-free" or "non-dairy" products. This did not concern me too much because these foods' principal markets seemed to be in supermarkets rather than in health food stores and because a nutritionist interested in cholesterol, a rabbi and a food allergist might well have different opinions on what constitutes "milk-free."

ARTHUR LIETZE, PH.D.
Immunochemist
Samuel Merritt Hospital
Oakland, Calif.

What about TV ads?

Some of the claims made for health foods, "organic" or otherwise, are ridiculous, but no more so than some of the breakfast food advertising that is so prevalent on TV. I recently heard a processed potato food being advertised as made from "fresh picked, young potatoes." Anyone familiar with the harvesting of potatoes will realize how ridiculous that statement is.

DAVID TAYLOR
Waukegan, Ill.

You are right. The claims for health foods are often no more ridiculous than those made for breakfast foods and other foods bought by a wide segment of the American public.—Ed.

UFOs—maybe?

I read with interest your This Month column regarding UFOs in the March 1969 issue. I'm neither a "true believer," nor in your sense of the term, a "buff." I do, however, think some UFO incidents deserve careful consideration.

It has always been my understanding that the true scientist approaches his problem with an open mind, putting aside all personal or private opinions or prejudices. I don't think this has been so with regard to UFOs. Incidents of trained

observers, or even stable and reputable citizens, have been treated with very much the same attitude as the nut. It would seem that men are more interested in their "image" than in teaching men the truth. Is science a purely personal thing, or is service to man behind it?

A. B. LAURENS
Norwood, Pa.

An 'Odyssey' theory

I have a different theory about the conclusion of Stanley Kubrick's "2001: A Space Odyssey."

Obviously the writers of the film had done their homework in background reading on space. Surely, then, they read Albert Einstein—or his popularizers, like Lincoln Barnett. In the light of Einstein's space-time continuum and his concept of curved, finite space, surely "2001" postulates that David Bowman has "circumnavigated" the finite universe at a speed approaching that of light. He therefore returns to his space-and-time Ithaca just as Odysseus returned to his insular Ithaca. Remember that Odysseus was often called by Homer "the wily bowman." David's Ithaca was his birth—or rebirth, if you will. Since all time and space exist, it makes no difference whether you call David's Ithaca birth or rebirth. Remember that in Einstein's time-space there are no simultaneous events.

WILL C. JUMPER, PH.D.
Ames, Iowa

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Pictorial Parade

A summer snooze

THERE'S NOTHING that beats a long nap in the warm summer sun. At least that's the philosophy of a fully-grown, male, Soviet-owned giant panda named An-An. He was brought to the London Zoo to mate with Chi-Chi, a British-owned female panda. But he has consistently refused to have anything to do with her—it's too comfortable on that log.

ADVENTURES IN

Science & Discovery

IN THIS ISSUE

The peaceful nuclear explosions Can we really put underground nuclear blasts to work for us without serious danger? Page 7 has some answers as told by Dr. Glenn Seaborg, chairman of the AEC.

The power of tea A tall glass of iced tea is a welcomed treat for most of us, but how many of us know about the scientific research in biochemistry that is behind every cup. The tea-tasting begins on page 72.

The underground movie thing has finally surfaced Nudity, bizarre sexual outlooks, artistic revolution and sensationalism have come to the flicks. Even computers are making movies. See page 43.